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# Economic Simulus: Online Economies, Virtual Currencies, and Their Relevancy to the Real World

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# Economic Simulus

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*Online Economies, Virtual Currencies, and Their  
Relevancy to the Real World*

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**Honors Thesis 2013**

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## Introduction

Time and time again, economics as a discipline has been criticized, particularly heavily during times of economic fluctuations and hardship. The public sometimes expects economists to be able to predict the ebbs and flows of the economy, and to perfectly model human behavior. Even if the field had perfect equations to model human behavior, and there is significant debate within the field if such a thing is even possible, economists must often rely upon flawed data. In order to create the sort of equations that might predict the next recession, or to measure how many people are unemployed, economists must aggregate a massive amount of data that can sometimes not be fully characteristic of a population. Economics frequently deals with the problems of having to collect often ambiguous data, from sometimes less than reliable sources, which may lead then to having models that lack predictive power. This often leads to frustration from both economists and the masses, who understandably get irritated about models that don't appear to accurately reflect the real world. However, some in the field have begun to recognize a potential new avenue for the aggregation of data and the facilitation of representative experiments.

Dr. Yanis Varoufakis, a Greek economist better known for his contributions to resolving the Greek-Euro crisis in Europe, was contacted by Valve Corporation, a video game development and publishing company famous for their flagship franchises such as Team Fortress, Half Life, and Portal. Varoufakis noted his frustrations with the issue of the sketchy modeling, saying that economics sometimes "resembles computerized astrology: a form of hocus pocus that seeks to improve its image by incorporating proper science's methods,

displays, and processes.”<sup>1</sup> Economics, he says, “can only pretend to discriminate between mutually contradictory theories”. With better data and sources, however, a much better base from which to determine theory is presented. This new opportunity is derived from those online video games featuring dynamic economies and interactions between a global audience. The CEO of Valve, Gabe Newell, asked Dr. Varoufakis if he wouldn’t mind giving his company advice regarding the merger of two video game economies, each with different currencies, into one shared one. Varoufakis’ professional experience with the Euro Zone balancing various currencies into one was quite relevant to the topic, so he became intrigued, and eventually became a consultant for Valve. Valve’s video games feature large economies, with many transactions each year. Varoufakis states that this was “an economist’s dream-come-true. Think of it: An economy where every action leaves a digital trail, every transaction is recorded; indeed, an economy where we do not need statistics since we have all the data!” Whereas there are near-infinite amount of complicating variables that cloud data and models in the real world, the digital one is easier to control and observe empirically. He sees Valve’s digital economies as “a marvelous test-bed for meaningful experimentation”. One can “change the economy’s underlying values, rules and settings, and then sit back to observe how the community responds, how relative prices change,{and} the new behavioral patterns that evolve”.<sup>2</sup>

Typically, when an economist wishes to collect experimental data, they must either go to the real world for a field experiment, which present a myriad of problems, such as obtaining a representative population and being exceptionally complex, or create a lab experiment which

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<sup>1</sup> Yanis Varoufakis, Valve Economics Blog: <http://blogs.valvesoftware.com/category/economics/> (Jun 3 2013)

<sup>2</sup> <http://blogs.valvesoftware.com/category/economics/>



runs the risk of being too simple to be relevant. Economics is turning to increasingly sophisticated computer models of human behavior in order to be able to test hypothesis, but these too are subject to various biases. One must be careful to avoid selection bias, as many experiments are done with college students for instance, or must be sure to not introduce any bias while measuring, conducting or analyzing the outcome of the experiment. The conductors of experiments must also prevent themselves from influencing the behavior of the subjects, who may make choices based on what they think the conductor wants. Scope and population size are also important considerations, as they can vastly change the accuracy of any findings. Today, games present an additional opportunity with digital economies offering increasingly rich sources of economic data that can both be controllably measured and reliably obtained. Ultimately, they also show how economic activity knows no bounds, and markets emerge and function in even the most byzantine of circumstances.

This paper will primarily focusing upon three giants of the industry; *Guild Wars 2*, by Arenanet; *EVE Online*, by CCP Games; and *Team Fortress 2*, by Valve Software. Each of these presents a unique opportunity for analyzing potential linkages and resemblances of the games to the real world's economy, as well as potentially being a rich source of experimental data. It will begin by briefly discussing each of them so that a layperson can understand their design, their relevance, and compare and contrast between them, and will proceed to delve into aspects of economics that their markets are characterized by. After that, it will discuss certain irreducible similarities and differences between such games and reality, and will conclude with the lessons that can be drawn from them.

## Background on Games

### EVE Online

Few other games can claim to have the same level of statistical and economic depth as EVE Online. It is often referred to as a “spreadsheet simulator”, and a strong example of laissez-faire economics. EVE is a massively multiplayer online role playing game (MMORPG) published by CCP Games (based in Iceland), that takes place in the distant future and far away space. As the Washington Post puts it, “within this world, players build their own spaceships and traverse a galaxy of 7,500 star systems. They buy and sell raw materials, creating their own fluctuating markets. They speculate on commodities. They form trade coalitions and banks”.<sup>3</sup> The game takes place on essentially one “universe”, which means that whereas most other games have various servers that people might play on, instead the entire player base plays on one server (there are actually 4 servers, but there is one main one for most of the world, another for China, and two others for testing new software patches). Players create a character and are represented by it as an avatar while they are logged into the game. The player’s interface is much more technical than most other games of the genre, and the game is more difficult as well. At the moment, EVE has in excess of 500,000 total active players, whereas the most successful MMORPG, World of Warcraft, reached at its height over 12 million active subscribers. Perhaps due to the game’s complexity, the game’s player base’s average age is 27.<sup>4</sup> EVE is open-ended; games in this genre do not have a “final boss” and credits at some

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<sup>3</sup> Ezra Klein, The Washington Post: <http://www.washingtonpost.com/blogs/ezra-klein/wp/2012/09/28/the-economics-of-video-games/> (9-28-2013)

<sup>4</sup> Virtual Economy Research Network, “Interview with CCP: EVE currency traders ‘going to lose big’?” [http://virtual-economy.org/2006/10/02/interview\\_with\\_ccp\\_eve\\_currenc/](http://virtual-economy.org/2006/10/02/interview_with_ccp_eve_currenc/) (6-3-2013)



predetermined end, instead players are free to do what they wish (within the limits of the game). Players may fly around in space ships that they either craft or buy, and also dock at stations. Essentially, the activities that are available include exploration, crafting items and researching blueprints, buying and selling items, combat, and training one's character in various skills. One can also harvest raw materials from asteroids or from other activities. Players can either buy items directly from one another, or by placing orders on an auction house that essentially operates like Amazon's marketplace. Placing and selling orders incurs a certain percentage based listing fee, derived from the player's price of the item that is not refundable and is instantly lost/evaporates from the game's economy.

The developers, relative to most other online games, have a very hands-off approach with dealing with the game's economy and player behavior. This laissez-faire economic approach is seen throughout the economy and how the developers handle in-game intrigue between players. The lead online economist for the game, Eyjolfur Gudmundsson, states that CCP wanted the economy to be hands-off as much as possible; centrally managed economies "failed in the Eastern Bloc, it will fail online as well".<sup>5</sup> The developers are known to quietly and subtly tweak the rates by which an item is obtained, but due to the ingenuity and attention of players paid to the market, prices often quickly respond to the measures.<sup>6</sup> In one instance, a rare ingredient was made more difficult to obtain on a test server (not the primary one) after the developers saw it becoming too cheap, and players responded by speculating on the price and made it rise precipitously. While players typically cooperate in online games by necessity, a

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<sup>5</sup> Dave Kosak, "Virtual Greenspans: The Economics of EVE Online" <http://pc.gamespy.com/pc/eve-online/855380p1.html> (6-3-2013).

<sup>6</sup> <http://pc.gamespy.com/pc/eve-online/855380p2.html>

deliberate step back by the developers from policing the game has led to many infamous tales of intrigue and backstabbing, sometimes resulting in the loss of thousands of dollars' worth of virtual items and currency. An exceptionally large Ponzi scam in EVE Online allowed two players to steal approximately 1 trillion ISK (in-game currency), the equivalent of \$51,677.<sup>7</sup> As the CEO and CMO of the game note, "trust is a very scarce commodity in EVE."<sup>8</sup> At one point, a group of players essentially said that they wished to halt an entire sector of virtual space in the game and prevent economic activities; the developers essentially responded: Good luck. They merely watched the ensuing battles, beefed up their hardware, and measured all of the data and put graphs up on their blog of what was happening, and the players had their war.<sup>9</sup> Further, in one past incident, a player lost the equivalent of \$1,300, but a recent enormous space battle resulted in the loss of an equivalent of \$15,000 dollars<sup>10</sup>

## Guild Wars 2

*Guilds Wars 2* is an example of a more orthodox example in the MMORPG genre, but one that still has a more advanced, interesting, and intricate economic system than many others. As opposed to EVE's single active server for most of the world, players are spread across numerous servers, with thousands playing on each one. Arenanet, the developer of the game, has not announced how many active players there are in the game, but over 3 million copies of the game have been sold. Further, as opposed to EVE, this game does not require a subscription

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<sup>7</sup> Brendan Drain, "Biggest EVE Online scam ever recorded nets over a trillion ISK", <http://massively.joystiq.com/2011/08/12/biggest-eve-online-scam-ever-recorded-nets-over-a-trillion-isk/> (8-12-2011)

<sup>8</sup> [http://virtual-economy.org/2006/10/02/interview\\_with\\_ccp\\_eve\\_currenc/](http://virtual-economy.org/2006/10/02/interview_with_ccp_eve_currenc/)

<sup>9</sup> CCP Explorer, "Observing the 'Burn Jita' player event" <http://community.eveonline.com/news/dev-blogs/28640> (2-5-2012).

<sup>10</sup> Brendan Drain, "EVE Player destroys over \$1000 worth of game time", <http://massively.joystiq.com/2010/08/08/eve-player-destroys-over-1000-worth-of-game-time/> (8-8-2010).



to be paid to the developers in order to access the game, but simply the purchase of the software. The game is more linear than EVE, offering an optional central story for players but still leaving the player's decisions with what to do with their time up to them. It is more typical "High Fantasy" in terms of style than EVE, featuring dragons, outlandish races, magic, and the like. Gameplay wise, players control a physical avatar character, and have various options as to what they can do within the game. Typical activities include fighting monsters and undertaking quests to level up your character, skilling up your character's professions by practicing crafting recipes, making money by either doing quests or selling items to other players, or from completing in-game dungeons. Players may collect raw resources and commodities within the game by either directly harvesting them from scattered resource nodes, or from "looting" the fallen bodies of enemy characters. Players also have the option to compete against other players in specific "instances," meaning separated from the primary server's world map and on another map, competitive team-based player vs. player environments.

Some of the more interesting characteristics of Guild Wars 2's economy include the nature by which its economy functions, the addition of a store-bought virtual currency and store that allows the player to purchase currency solely with in-game earned gold, and how its auction house functions on a global scale. First of all, relative to EVE Online, the developers are more often and more heavily involved in the economic goings-on in the game, and swifter to ban players for discouraged economic activities. For instance, Arenanet will radically change the acquisition rates of items when they feel that the rate is too high (or low). A typical example might resemble an October 2012 update where they wrote in patch notes that they had "reduced amount of walnuts dropped from nodes from 3,5 to 1,2. Walnuts now only come



from soft wood nodes.”<sup>11</sup> This refers to how many walnuts would be received by gathering from a certain type of resource node in the game, as harvesting a specific resource also allows one a chance of obtaining other, unrelated items. In one incident, Arenanet banned 3,000 players all at once for severely exploiting a bug, which allowed players to “craft high level weapons at ‘one thousandth of their normal price’” by obtaining various items for cheaper than they were supposed to be in a non-monetary currency, buying them en-masse, and then using an in-game mechanic to “fuse” them together in hopes of creating a more expensive and higher quality item.<sup>12</sup> “En-masse exploitation of the loophole threatened to flood the market with powerful items and destabilize Guild Wars 2’s Economy.”<sup>13</sup> Further, Arenanet’s economist at one point noted that there was excess supply in the markets that had the effect of depressing prices, so in order to bring prices up to what he saw as fair-market value, Arenanet created limited-time “Mystic Forge” recipes to urge players to use up these items, and receive chances for gold or rare items.<sup>14</sup>

This “fuse” mechanic, accomplished by combining items of the same quality in a “Mystic Forge”, is one unique mechanic to Guild Wars. It allows players to essentially gamble on a small chance of receiving an item of exceptionally high quality and value, which costs the player potential revenue from selling the items or by using the salvage mechanic to obtain raw commodities by destroying an item. This salvage mechanic is also an interesting and important

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<sup>11</sup> Guild Wars 2, “Update Notes- October 22, 2012” <https://forum-en.guildwars2.com/forum/info/news/Update-Notes-October-22-2012/> (10-22-2012).

<sup>12</sup> Tom Senior, “3,000 Guild Wars 2 players permanently banned for karma exploit”, <http://www.pcgamer.com/2012/08/31/3000-guild-wars-2-players-permanently-banned-for-karma-exploit/> (8-31-2012).

<sup>13</sup> <http://www.pcgamer.com/2012/08/31/3000-guild-wars-2-players-permanently-banned-for-karma-exploit/>

<sup>14</sup> John Smith, “John Smith on the State of the Guild Wars 2 Economy”, <https://www.guildwars2.com/en/news/john-smith-on-the-state-of-the-guild-wars-2-economy/> (9-14-2012).



aspect of how the game's economy functions. A player has the option of, for a nominal fee, purchasing "salvage kits" from non-player characters and then using them on armor or weapon items in game, which results in the random acquisition of certain raw materials. One has the chance of receiving a minimum level of return, or certain rarer inputs that can be used in crafting other items, or sold to other players. In effect, it has a large opportunity cost in terms of the forfeited revenue, but potentially high rate of return. This is primarily a means introduced by the developers to reduce inflation, of which there are many mechanics within the game that do so as well.

A model that has become increasingly popular in many online games, whether on iPads, Playstations, or computers, has been a move by developers to make a significant portion of their revenue if not all of it, not from direct sales of the software itself but from micro-transactions within the games. Many companies have begun to design their games around these transactions being a primary source of revenue; well-known companies like Zynga, Riot Games, or Electronic Arts among them. Frustrated parents may have run into situations in the past where their children may have tinkered with the family iPad and "accidentally" purchased obscenely expensive virtual cosmetic or functional items using real currency. There have been numerous stories of children accidentally spending hundreds of dollars in such a way before their parents find out. Many online games are beginning to move towards this model instead of the more typical subscription-based payments or software box purchases to access a game.

Arenanet's first Guild Wars game was somewhat unique in the industry in that they charged for the game's software, but did not charge a subscription fee. Instead, their model has been to utilize an in-game store that requires the use of a currency known as "gems", separate



from the one earnable from in-game activities. Typically, this currency is purchased at a certain rate; 100 gems cost \$1.25 to buy, and can be bought in various increments; 4000 gems at \$50, and 2800 at \$35. These gems are used to purchase in-game cosmetic upgrades or items, in addition to “boost” that might give your character increased experience from completing tasks, skill up faster from crafting, etc. However, the interesting aspect of this is that Arenanet has an in-game mechanic to “exchange” the typically earned in-game gold for the store-bought gems, and vice versa with other players. This action was likely partially done in order to take some of the possible revenues that virtual currency sellers usually make in the game for the company instead, but it still has not deterred their activity on the game. At the moment, selling 100 gems for gold nets 2 gold and 28 silver, and the rate for buying 100 gems is 3 gold and 15 silver.<sup>15</sup> For scale, a 10 minute activity might net, on average, several silver, and 100 silver are in each gold. A difference in the exchange rate for gems and gold exists, so that the ratio is not 1:1. When Arenanet introduced the game, they made clear that, besides selling gems to the players, they did not interfere with the rate that the gems and gold are traded for, and the rate is entirely market driven. However, it’s somewhat in their interest that the rate by which gold is traded for gems is low, as they would probably prefer more people to buy gems via cash, which is their ongoing cash flow after the software is purchased.

Many other MMORPG games do not have quite the audience and scale of the economy that Guild War 2 possesses, and the global economy possessed by the game adds to the game. In the most famous example of an MMORPG, World of Warcraft, servers have vastly different sized populations of players and economic activity is based solely off of each server by itself.

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<sup>15</sup> Guild Wars 2 Spidy, “Gem Exchange Rate”, <http://www.gw2spidy.com/gem> (6-5-2013).



This often leads to both wide price variations and the ability for certain wealthy actors to more easily gain control of sections of the auction house, such as potions or raw commodities. It isn't unheard of for a single player to essentially game the auction house in such a way that they create a monopoly, and extract significant rents from players in these sorts of situations, much like a tycoon. In Guild Wars 2's case (but also TF2), the auction house is instead fed by every single server, not just one. Thus, this leads to a significantly different dynamic in the economy. As the game's economist John Smith notes, "this means that each server, and each player in the whole world participates in the same economy, instead of each server hosting its own economy. This also means that all the markets the game creates move much, much faster than any other game and at a much higher volume."<sup>16</sup> Because of the immense amount of competition, and the homogeneity of products within the game, one of the rules in economics is that perfect competition leads to zero economic profits, which is often seen within the game. Items that are easily obtainable barely hover, if at all, above the price they can be liquidated straight to the server instead of sold to another player. Smith notes in the case of perhaps having trouble selling finished cooking products within the game, "there are millions of players participating in the market and almost no barrier to entry for cooking, so the profit margins for the markets come and go really quickly because of the vast amount of participation."<sup>17</sup>

The nature of the size of the economy renders it difficult to control by any one small group, but instead driven by the player base as a whole, and more resilient to supply and

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<sup>16</sup> Laura Hardgrave, "John Smith on the Guild Wars 2 Economy", <http://gw2.junkiesnation.com/2013/03/20/john-smith-on-the-guild-wars-2-economy/> (3-20-2013).

<sup>17</sup> <http://gw2.junkiesnation.com/2013/03/20/john-smith-on-the-guild-wars-2-economy/>

demand shocks than other games' markets.<sup>18</sup> However, this of course does not render the game immune to severe changes in prices that may occur nearly instantly. A certain ingredient for crafting, Mystic Coins, experienced an exceptionally large price increase after players learned they were required to craft high quality items, resulting in a price change of around 1 silver to a maximum of 15 several months later. However, the price has fallen back down to around 5 silver 3 months after its peak.<sup>19</sup> Major day-to-day changes of prices are obvious as well; an item used in the creation of a basic armor piece had its price drop 30% and then rise back up to its initial position shortly after, all in the course of less than a day. Prices can be exceptionally volatile, especially in the case of days with updates that include the introduction of new events or recipes that boost demand for certain items. These sorts of occurrences are rather common across all of the listings.

## Team Fortress 2

Jokingly referred to by many as a hat-based economy, or as a hat simulator with a war theme, Team Fortress 2 is a particularly interesting case of a virtual economy, but one that is substantially different from the other two preceding examples in many ways. Developed by Valve Corporation, based in Bellevue WA, it is a first person shooter game (think Call of Duty) that is played online with up to 32 players active on a single server at a time. The player base is typically "older" (meaning mid 20s and older), and tens of thousands of people play each day. The game is based on a very stylized world, one inspired by "early 20th century commercial

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<sup>18</sup> Guild Wars 2 Ru, "An interview with Guild Wars 2 team", <http://guildwars-2.ru/an-interview-with-guild-wars-2-team/> (3-19-2013).

<sup>19</sup> Guild Wars 2 Spidy, "Mystic Coin[s]", <http://www.gw2spidy.com/item/19976> (6-5-2013).



illustrators J. C. Leyendecker, Dean Cornwell and Norman Rockwell.”<sup>20</sup> Players have the option of choosing from one of nine classes to play at any one time within the game, each of which has substantially different strengths, weaknesses, and combat style. These classes range from a large Russian who utilizes a minigun, a one-eyed black Scotsman who uses a grenade launcher, and a misguided Australian who employs a sniper rifle, among others. However, the gameplay itself is only one aspect of the overall experience in the game. Team Fortress 2 also features a robust crafting and trading system, which allows players to create, use, and trade various in-game items to other people around the world. Players have an inventory from which they can choose what items to equip to their active character, ranging from headwear, primary/secondary/melee weapons, and pieces of flair such as an inflatable unicorn. In this respect, TF2 begins to resemble certain MMORPG games that allow players to choose the sort of equipment their in-game character wears, as well as the capability to craft certain items. However, TF2 is significantly different in terms of how its economy functions relative to most MMORPGs.

TF2’s economy both exists outside and inside of the game, and is primarily enabled by the game’s trading function and takes place entirely outside of the game in terms of price negotiations and buyer/seller matching for more valuable items. Numerous forums and venues exist for players to post the items they desire, and their offers. Exchange rates created by the community are widely known and listed by reputable online websites. Some of these rates fluctuate very often and quite widely. During specific events where new items are introduced, there are significant opportunities for savvy players to take advantage of these rates offering

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<sup>20</sup> Valve Software, “*Illustrative Rendering in Team Fortress 2*”, [http://www.valvesoftware.com/publications/2007/NPAR07\\_IllustrativeRenderingInTeamFortress2.pdf](http://www.valvesoftware.com/publications/2007/NPAR07_IllustrativeRenderingInTeamFortress2.pdf) (6-5-2013).



chances for profit, but these opportunities decline as the economy becomes more sure of an item's value.<sup>21</sup> Certain items, due to either their rarity, how common they are, or by the nature of their acquisition have become de-facto currencies in the game, and used for bartering. For instance, "earbuds", an item worn in the miscellaneous slot for characters that resemble Apple's iPod earbuds and were only obtained by players that logged into the game from Apple's iOs during a certain period of time, have a rough cash value of \$35. Nearly every valuable item is measured in terms of a number of earbuds, due to their ubiquity. Scrap metal is an in-game commodity-like item, which can be used to craft various items and hats, or with certain recipes essentially gamble by crafting a certain recipe and receive a random hat. It is obtained by "smelting" identical pieces of equipment together, resulting in this raw material. Because of its ease of obtainment, it has a specific relative value to most items that is known to the community. For certain more expensive items, usually hats with special "unusual" particle effects, reputable members of trading forums will act as middle men to trade the item to the buyer once the seller has received their payment in the case of money exchanged via Paypal. These "unusual" hats can run upwards of \$4000, but average closer to \$50-300.<sup>22</sup> One of the most expensive hats, a "Burning Flames Team Captain" costs 119.9 buds, or equivalent to \$4200.<sup>23</sup> The most valuable "backpack" of a player that is publicly known is approximately \$39,000.<sup>24</sup> An analyst in 2011 estimated the value of the economy at around \$50 million, mostly

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<sup>21</sup> Yanis Varoufakis, *"Arbitrage and Equilibrium in the Team Fortress 2 Economy"*, <http://blogs.valvesoftware.com/economics/arbitrage-and-equilibrium-in-the-team-fortress-2-economy/#more-128> (5-22-2012).

<sup>22</sup> TF2 Finance, *"TF2 Average Unusuals Price"*, <http://tf2finance.com/unusuals/> (6-5-2013).

<sup>23</sup> Backpack.tf, *"Unusual Pricelist"*, [http://backpack.tf/unusuals/378/Team\\_Captain](http://backpack.tf/unusuals/378/Team_Captain) (6-5-2013).

<sup>24</sup> Backpack.tf, *"Mattie!"*, <http://backpack.tf/profiles/76561197971691194> (6-5-2013).



due to hats and other unique items.<sup>25</sup> These special hats represent the most sought-after items in the game's economy. Finally, "keys" bought from Valve's official store have a baseline value of \$2.50, as that is how much they cost to obtain from the store, but they run closer to \$2.00 due to being devalued by players sitting on them and using them to trade.

Similar to Guild Wars 2, the game features an in-game store that sells various weapons, hats, cosmetic items, and others for real money. For instance, a newly released hat might run approximately between \$5 and \$12.50, or a weapon between \$0.50 and \$5.00. Many of these items were designed by the community, and Valve distributes up to six figure shares of earnings to the top creators of items.<sup>26</sup> These prices essentially set a maximum price that players are willing to pay for items, so aspiring traders must beat them in order to sell or trade their products. Players may also choose to "smelt" down these items into raw scrap metal, but it's expensive and not common for people to do so. Further, they may also trade them to other players only after a certain period during which they cannot be traded has elapsed. Team Fortress 2 used to be a typical online game in that you only paid to buy the software and you had full access to the game, but the developers have made a deliberate shift to the micro-transactions model and made the game free to play while at the same time introducing the in-game store. There are certain restrictions on free to play players, such as a restricted backpack size, and restrictions on what they can trade or receive. However, these are lifted if the player puts any amount of money into the in-game store, at which point they become a normal, "premium" member without restrictions. The game has been substantially redesigned in order

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<sup>25</sup> Owen Good, "Analyst Pegs Team Fortress 2 Hat Economy at \$50 Million", <http://kotaku.com/5869042/analyst-pegs-team-fortress-2-hat-economy-at-50-million> (6-5-2013).

<sup>26</sup> Craig Pearson, "Valve's Robin Walker on six figure item sales and the future of modding", <http://www.pcgamer.com/2013/01/11/valves-robin-walker-on-six-figure-item-sales-and-the-future-of-modding/> (1-11-2013).



to facilitate profits via the store. First of all, items now randomly drop at some unspecified rate during the time player's time spent on a server, up until 10 hours of gameplay have elapsed. This has led to many players going "AFK" (away from their keyboards) and simply leaving their character idle on a server without actually playing, in hope of earning items. Valve has a system to typically prevent idle players from receiving items and will penalize those using client-based scripts to do so, but due to the nature of these idle servers, they get around this mechanic.

To combat this, Valve has instituted a weekly resetting cap on the amount of items a player can receive from playing game time of about 11 items. Players have a chance at obtaining an item at regular intervals of every 30 to 70 minutes, until they have played for around 10 hours at which point they no longer have a chance.<sup>27</sup> They previously had a maximum amount of items that could be traded between players as well. Additionally, Valve has introduced items called "crates" to the game, which have a separate drop counter to the normal items, but give the player a chance at receiving both otherwise accessible items through either crafting, drops, or the store, but also inaccessible items such as the "unusual" hats. In order to open a crate, a player must use up a key, which are only obtained through the in-game store, or from players that previously bought keys from the store. The crates have something like a 1% chance to give out "unusual" hats, and there are certain particle effects much more in demand by the community and thus more valuable. Some of these include a rain cloud floating above one's hat, revolving hearts, or a hat appearing to be on fire.

Further, in addition to the in-game store, Valve has semi-recently introduced a market which enables players to sell certain items on the company's Steam software client, and when

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<sup>27</sup> Team Fortress 2 Wiki, "Item Drop System", [http://wiki.teamfortress.com/wiki/Item\\_drop\\_system](http://wiki.teamfortress.com/wiki/Item_drop_system) (6-5-2013).

an item is sold the balance is essentially applied like a gift card balance to the company's service that sells a variety of other games and services as well. However, due to the 15% tax that the company extracts from the revenue, the preference for many players for cash when it comes to expensive items, and the limited items that can be sold on the market, its utility is somewhat limited. However, its prices still change to reflect in-game events such as patches and recent updates.

### Comparison and contrasting of the games

It is important to distinguish between and compare them before the actual economic significance of their markets are discussed. It is particularly relevant to discuss their differences in their economies. First of all, Team Fortress 2's economy is mostly enabled by in-game events, such as when Valve releases new items or by the game's trading function, but the high value trades are seemingly mostly valued and listed outside of the game, on various websites. This is in direct opposition to EVE and Guild Wars 2, where the in-game economy is essentially the forum for all economic activity, and the values are determined solely within the games themselves. As EVE's CEO notes, "very few ships or items are being traded on EVE secondary markets. I think this is a measure of how efficient the in-game commerce is."<sup>28</sup> They have auction houses and in-game trading as the majority of their economy, and the only transactions that take place out of the game are mostly the exchange of real money for in-game currency.

A second important difference between the two games is simply the nature of the developer's interactions with the games. Guild Wars 2 and TF2's developers essentially need an

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<sup>28</sup> [http://virtual-economy.org/2006/10/02/interview\\_with\\_ccp\\_eve\\_currenc/](http://virtual-economy.org/2006/10/02/interview_with_ccp_eve_currenc/)



economy functioning in order to profit from the game due to their micro-transactions models, so they have made deliberate design choices so that they will profit from the actions of players. Guild Wars 2 and EVE both have store-bought currencies (gems and PLESK); whereas TF2 essentially has items that then become barter currencies for players. While GW2 and EVE have in-game auction houses set up to facilitate player trade, TF2 lacks such a mechanism and setup.

More-over, GW2 and EVE have much more frequent developer intervention with regards to setting drop rates of items within the games, which isn't quite as relevant to TF2's economy. TF2's developers mostly have an influence on the economy from introducing new items, and not much more than that. GW2's developers are much more involved with directly changing the function and value of items than the other two games', and more likely to punish players for bad behavior within the game, whereas EVEs have essentially sworn off doing so for anything up to a certain high level. In response to a massive bank heist within the game, the CEO says that while theft isn't cool, it's part of the game, and those who fall for it "have nobody to blame but themselves."<sup>29</sup> The player base of EVE is significantly more cutthroat than either of the two games discussed, with the very frequent backstabbing and theft stories spread throughout various forums. However, players must necessarily cooperate more, due to the difficulty in going it alone without a support group to protect oneself during activities within the game. On the other hand, one thing that EVE's developers have done is attempt to give the players perfect information regarding the economy, going above and beyond other developers to create a true laissez-faire and perfectly competitive market. EVE's CEO and CMO state that "we definitely want to make the point that the EVE economy is a real economy in the sense that

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<sup>29</sup> [http://virtual-economy.org/2006/10/02/interview\\_with\\_ccp\\_eve\\_currenc/](http://virtual-economy.org/2006/10/02/interview_with_ccp_eve_currenc/)



it operates according to real-life economic concepts.”<sup>30</sup> They release economic reports, provide historical data regarding items’ prices within the game itself, and give notices on updates and activities on their end.

A third critical difference is the lack of a specific single currency in TF2, whereas GW2 and EVE have a single primary currency, gold and ISK respectively. This forces TF2 to become primarily a barter economy, and Dr. Varoufakis perceives this as leading to rampant speculation and many arbitrage possibilities with all of the fluctuation in exchange rates. This might occur because items aren’t released with some certain monetary value, and it may take some time for players to learn the relative value of goods based on their looks, usefulness, and rarity in the game. It also complicates analysis of the game; whereas the prices of items in GW2 and EVE are essentially written in stone and immediately obvious, it may take some mental work to construct exchange rate between various items. For example, a hat may be worth 5 earbuds, and each earbud is worth 20 refined scrap metal, and so on. A player must rely on the accuracy of online exchange rates, or essentially word of mouth from within the game to ensure that they are not ripped off from any particular trade.

An important topic to discuss is also the real world value of these currencies. When it is said that the currency is equivalent to a dollar value, it does not mean that it is immediately redeemable for cash value, but instead this currency (i.e. “ISK”) can buy another currency that is redeemable for a currency that can pay for the game’s subscription cost (i.e. “PLEX”); this is the typical way by which in-game currency for EVE is related to a real-life dollar value. This isn’t quite the same for Guild Wars 2 and Team Fortress 2- In Guild Wars 2, you can purchase with

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<sup>30</sup> [http://virtual-economy.org/2006/10/02/interview\\_with\\_ccp\\_eve\\_currency/](http://virtual-economy.org/2006/10/02/interview_with_ccp_eve_currency/)

credit or debit “gems”, which can then be sold via a central mechanism to other players for gold, thus creating a value for the gold. With regards for Team Fortress 2, items are often bought with cash or Paypal, using a trustworthy intermediary in order to facilitate the trades, or the current exchange rate between an item with an explicit value (“earbuds”) can give something a dollar rate. However, there exists a “black market” for virtual currencies for most games, including EVE; people from Southeastern Asia often use “bots”, or autonomous scripts that control a character in-game to “farm” (repeatedly search for and obtain) items and then sell them at typically below-market prices. They then sell the resulting currency on the internet, requiring a Paypal account or credit card in order to get them to trade the money to your in-game account. This is essentially done on faith, but is heavily looked down upon by the community and developers, and can get you and the seller of the currency banned from the game for violating a game’s terms of service. These farmers generally flood the market and can cause prices for items to rapidly fall, making normal players efforts to obtain them not worth their while. This is a problem for nearly every game, and the genre is rife with examples of markets being cornered by botting players, or from Chinese websites using keylogging software and sending spam emails to players in order to trick them into installing it on their computer and allowing them to steal accounts, and then liquidate the accounts and sell the person’s belongings. Nearly every player of these games knows someone, if not themselves, that has experienced hacking of their account after carelessly opening a scam email containing spyware.



# Lessons and Parallels Between Games and Reality

## Introduction

The macroeconomic environments of these games particularly reveal close similarities in how their economies react to in-game and external events and how the real world reacts to various sorts of shocks, in addition to various mechanisms that characterize a broader economy. While there is a limit of many parallels can be drawn between the two, as these games only have limited sophistication relative to the real world, we can see various common economic concepts, and their appearances in the games and how the manner in which circumstances may occur reflect how they often in the real world, but sometimes with a minor twist. In a game not thoroughly discussed by this paper, Sony's EverQuest 2, a group of players manipulated the system by creating massive amounts of currency, and caused the "game's economy to suffer 20 percent inflation in just 24 hours before being caught"<sup>31</sup>, a number that has been even dwarfed by daily inflation in countries such as Greece, Zimbabwe, and Hungary seeing rates of up to 207% inflation each day in the past.<sup>32</sup> Regulators and lawmakers in the United States have surprisingly similar concerns about how to maintain the integrity of an economy as do the developers of a game, although fewer tools are necessary to maintain some manner of stability within a simpler economy. The following paragraphs will begin by introducing the relevant economic concepts, explaining them so that they might be understood

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<sup>31</sup> Daniel Terdiman, "EverQuest II economy slammed by cheaters", <http://www.gamespot.com/news/everquest-ii-economy-slammed-by-cheaters-6130888> (8-12-2005).

<sup>32</sup> Steve Hanke and Alex Kwok, "On the Measurement of Zimbabwe's Hyperinflation", <http://www.cato.org/sites/cato.org/files/serials/files/cato-journal/2009/5/cj29n2-8.pdf> (Spring/Summer 2009).



by the layperson, and then proceed into comparing and contrasting events in the games with how they occur in reality, and then conclude with a discussion of lessons to be learned.

## Inflation

One of the most common scourges of games, in addition to real economies, is inflation. Inflation refers to “a process of continuously rising prices, or equivalently, of a continuously falling value of money”.<sup>33</sup> One might notice this in their own life, seeing a dollar that previously bought two cans of soda in the past be only able to purchase one can now. A rise in the level of inflation may reduce the consumer’s purchasing power for their normal goods, and thus lower their standard of living. It is also important to discuss the difference between nominal prices and real prices. Nominal prices refer to the day-to-day price of an item. If a bag of chips is sold for \$1, its nominal price would be referred to as one dollar. However, real prices are measured in some year’s dollars, used as a constant. This year can be arbitrarily chosen. For instance, you might say the cost of this bag of chips in 1990 dollars would actually be \$1.50 (i.e. you would have had to paid 1.50 for it in 1990), showing its price to have decreased over time. However, if you had bought a cup of coffee for \$1.50 real dollars in 1990, and it costs \$3.00 now, the price of the item has appreciated. There are various indexes to measure inflation throughout time. One of the most common is the Consumer Price Index, which “captures the change over time in the cost of purchasing a ‘typical’ bundle of goods.”<sup>34</sup> In the United States, between the years of 1982 through 2009 the CPI rose by 124%, which indicates a 124% inflation in the price for a

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<sup>33</sup> Bureau of Labor Statistics, “Inflation”, <http://www.bls.gov/bls/glossary.htm#I> (6-5-2013).

<sup>34</sup> Jonathan Gruber, *Public Finance and Public Policy* (New York: Worth Publishers, 2011), 98.



typical consumer's bundle of goods (buying the same good requires giving up 124% more of other consumption than before).

Particularly high inflation rates can have and have had devastating effects throughout history- in the post-World War I era, Germany's currency was so devalued that there are many examples of Germans being forced to bring wheelbarrows full of near-worthless currency to the store, just to be able to buy some simple groceries. At one point, one dollar was worth over 420 million Marks.<sup>35</sup> The United States has also had various periods of very high inflation. One of the most famous, known as the Great Inflation, involved the time period between 1960 and 1979, when "annual US inflation increased from a negligible 1.4 percent to 13.3 percent," which lead to unstable prices, wages, and a substantial loss in faith in the economy.<sup>36</sup> The opposite of inflation is deflation, which involves a decrease in the value of goods and services, or a negative inflation rate. This can lead to increases in the real value of debt, and sometimes reductions in production, which can be followed by diminished wages and demand, and basically a downward spiral in prices and the previous issues again. A concept partially driving the government's response to unemployment and inflation, the Philips Curve, essentially indicates that there is a fixed tradeoff between unemployment and inflation.<sup>37</sup> The government cannot decide to have both, but must instead choose how much to prioritize one over the other.

During the years of President Reagan's administration, the Federal Reserve while headed by Paul Volcker, took various measures in order to reign down the level of inflation. Among the measures the Fed took in order to lower inflationary expectations were that it

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<sup>35</sup> Mises Institute, "*The Economics of Inflation*", <http://mises.org/books/economicsofinflation.pdf>, 335 (6-5-2013).

<sup>36</sup> Robert J. Samuelson, "*Lessons From the Great Inflation*", <http://reason.com/archives/2008/12/18/lessons-from-the-great-inflati> (6-5-2013).

<sup>37</sup> <http://reason.com/archives/2008/12/18/lessons-from-the-great-inflati>



“raised interest rates, tightened credit”, and various measures to reduce the overall money supply.<sup>38</sup> This resulted in a very substantial economic downturn, but ultimately the inflation rate has been locked closer to around 2 or 3% for the past couple decades, and consumers and businesses have not had to worry about unpredictability. The Federal Reserve now maintains a policy of aiming for a 2% inflation rate, as to fulfill its mandate for price stability and maximum employment.<sup>39</sup> Another possible negative aspect of inflation for the average person is called the “inflation tax”, which effectively refers to the devaluation of those holding liquid assets like cash, or those with bonds.<sup>40</sup> For instance, you might have a bond that pays out in nominal dollars, which would be worth less in real terms due to inflation, or the \$50,000 in your savings account can now only buy \$45,000 of goods. This can, in effect, punish those that have not invested into material assets whose prices track inflation, or those who save money. However, all is not terrible in the case of inflation; those who have significant debt see their earnings rise in real terms, while the nominal value of a loan would remain the same. However, one is understandably upset if they can no longer buy as many of an item, despite their wages and savings staying the same, for reasons outside of their control.

The games discussed in this paper are also rife with examples of historical inflation, and of corresponding “government,” or in this case developer, action to bring prices down to what the team thinks them to be. In particular, EVE online has been very up front with both presenting economic data, explaining its relevance, and of stating where they expect prices to end up. The team has constructed various indices of commodities traded within the game as to

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<sup>38</sup> <http://reason.com/archives/2008/12/18/lessons-from-the-great-inflati>

<sup>39</sup> Board of Governors of the Federal Reserve System, “*Why does the Federal Reserve aim for 2 percent inflation over time?*”, [http://www.federalreserve.gov/faqs/economy\\_14400.htm](http://www.federalreserve.gov/faqs/economy_14400.htm) (6-5-2013).

<sup>40</sup> Gruber, 99



map economic trends and measure inflation. Particular events are frequently and predictably common to lead to large inflation within the game, such as a new update that leads to a massive amount of new players and increased demand for products, resulting in a rapid increase in prices within the game. Further, just as in the real world, a war or disruption of the typical rate of how commodities are obtained may also lead to changes in the overall value of currency; scarcer items caused by conflicts cause prices to go up, or a government “printing” currency to pay for a war and devaluing money may do so as well. Finally, a government (or game in this case) printing money without a sufficient amount leaving circulation as to maintain a steady level of inflation may also lead to a vast decline in the value of currency.

An example of the impact of an update on inflation, combined with a war and disruption to acquisition of resources in a game would involve EVE’s economy’s response to the release of an expansion titled *The Crucible* November 29th. After its release, players began increasingly demanding materials within the game, partially to be able to craft new items introduced in the game, which drove up their prices. Further, the developers made a public announcement involving future “drastic changes” to the rate by which these materials were obtained, which caused a rapid increase from speculation in the “Daily Mineral Price Index” (**figure 2 in appendix**).<sup>41</sup> The index saw a steady increase for a couple months previous to the announcement, reaching a price 40% above the index price. However, at the time that the announcement regarding the future changes was made, prices rose much more rapidly, hitting up to 100% above the index price within a month. However, at nearly the same time, a group of players assembled to disrupt the main trade hub area of the game called Jita, causing

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<sup>41</sup> CCP Recurve, “The Economy ‘Burns’ (Price Indices- May 2012)”, <http://community.eveonline.com/news/dev-blogs/72833> (6-8-2012).



substantial destruction and loss of property.<sup>42</sup> This was only one aspect of the player's actions; there was an even larger player driven event, termed "Hulkageddon," which "aimed at destroying mining vessels and lasting a full month". It ended up suppressing the supply of minerals, which resulted in forcing the prices of the minerals to rise even further. However, players that had stockpiled minerals took this time to sell them off at the high prices, causing the prices to begin to decline. Using their in-game price Index for May, the month of the Hulkageddon event, the Mineral price index was at 125 (25% above index price), the one month change -7.9% from the previous month, and a 65.1% increase from the previous 12 months.

Another of the games, Team Fortress 2, has experienced a different, curious sort of inflation that may be explained by several other factors. As mentioned previously, Team Fortress 2 features items called keys, which are purchased from the game's store for cash originally but may be traded or bought from other players after originating from the store. These keys allow players the chance for unique particle effects on hats, which serve as the most expensive items in the game. Keys are often given a general rate of exchange in both dollars and in metal, which is obtained from smelting down items within the game. However, the MMORPG genre of games has a particular problem that the real world hasn't quite had to face: botting. As discussed previously, people can take advantage of the passive acquisition of items on Team Fortress 2 by creating numerous accounts and running them on one computer in hopes of obtaining items to turn into metal. Because of the outsized acquisition rate of metal by these players, which in effect costs nothing but an electricity bill and wear on your computer's parts, this has led to a devaluation in the purchasing power of metal relative to that

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<sup>42</sup> <http://community.eveonline.com/news/dev-blogs/72833>



of keys. A key used to be able to be purchased for about 2.5 refined metal, which is the equivalent to combining 36 weapons together for 18 scrap.<sup>43</sup> There are then 3 scrap to a reclaimed metal, and 3 reclaimed metal to a refined metal. To put that in perspective, the average player has the chance of obtaining only 11 items per week at most, so one could understand to be more than 3 weeks of "pay" (if the player was online long enough to maximize the amount of items they could acquire this way). Metal can be used to craft hats, but never those with the special unusual effects. At one point, Valve actually punished those engaging in this activity using external applications and not just idling servers, but eventually took measures such as adding the weekly item drop cap for items.

The rate of how many refined metals must be traded to obtain a key had been steadily rising over the 2011-2012 period, hitting a rate of about 2.61 refined to a key, until a specific update occurred by the Team Fortress development team. This update allowed players to earn additional, limited time unusual skins for hats, which caused keys to begin to rapidly increase in value relative to metal, but curiously did not increase in monetary value, in which they had been experiencing steady decline since mid-2011. The excess supply and increased demand resulting from the idling of players of metal made the currency have too high of a supply relative to the demand for keys, and from another perspective many players are reluctant to spend money on a game if they don't have to, so the exchange rate plummeted. It is also important to note that another special series of crate was introduced by the developers near the same point, further raising the value of a key relative to the metal. At the moment, 5.07 refined metal are required to purchase each key, and approximately 1.70\$ is required to buy

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<sup>43</sup> TF2 Finance, "TF2 Keys Price" <http://tf2finance.com/keys/>, (6-5-2013).



the average key from the market (it costs 2.50 to buy them from the store originally). In essence, the excess supply of the currency devalued it relative to the somewhat artificially limited currency or one at least obtained at a normal rate. Valve also put out a graph of how the value of three of the common in-game currencies changed over time, indicating that earbuds started at roughly 14 dollars, but have become valued closer to 26 at the end of the measured time period of Nov. 2011 to June 2012 (**figure 3**).<sup>44</sup> Bills Hat, another commonly used item for measuring value within the game that was received for preordering a game went from 6 to 9 dollars in the same time period. However, refined metal's value seems to have stayed relatively flat. As this is mostly a barter economy, the relative exchange rates of items have been particularly fluid and not tied to any specific values, and this may only be a temporary change.

### Inflation defeating measures in games

While some of the options available to institutions like the Federal Reserve aren't available to video game economies, the developers of the games possess numerous tools that the Federal Reserve does not, and other built-in characteristics of the game that work to eliminate what has been termed Mudflation, or in essence a devaluation of a massive multiplayer online games' currency. This is a relatively common occurrence, even with all of the tools that game developers and the economists working for the games have to utilize. At its core, inflation occurs in games because there is not much stopping developers from creating endless currency, as it isn't backed by anything within real life like a gold standard and is

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<sup>44</sup> <http://blogs.valvesoftware.com/economics/arbitrage-and-equilibrium-in-the-team-fortress-2-economy/#more-128>



basically just a number seen by players within the game. Online games with token-like currencies, much like the Federal Reserve does when it decides to add to the money supply, essentially print currency at no cost to the institution. The typical mechanism by which the Federal Reserve empties currency out of the economy is by selling securities to banks, and causing the money to be kept out of the economy. The difference with the Federal Reserve however, is that by simply playing the game as the developers intended it, can create large amounts of currency each time they log into the game. Fulfilling quests, defeating monsters and dungeons, and selling acquired items to non-player characters allow the player to acquire substantial capital within the game. If developers do not carefully balance how much money comes out relative to how much enters a game, its economy may be trivialized or crippled.

A very common problem for MMORPG games, particularly a game like World of Warcraft, occurs when the financial rewards given to players vastly increase each expansion, which then results in a large devaluation of the game's currency. When games like Team Fortress 2, EVE, and Guild Wars 2 are fairly dependent on the integrity of their economies to maintain their player base, frequent destabilizing events resulting from inflation can discourage players from playing, and thus paying for the game. Many people can be discouraged from "working" within the games if their activities netted them substantially fewer rewards in real terms due to inflation. Thus, there are numerous gold sinks implemented into these games, some being very simple mechanisms, and others being surprisingly complex. Guild Wars 2 and EVE share several, but Team Fortress 2 has some different ones by necessity due to its different genre and gameplay. EVE appears to have the most of any of the games.



Starting on the simpler side of inflation defeating mechanisms within these games, transaction costs are incurred when listing items on the auction house of EVE and GW2, in order to draw money steadily out of the economy. With EVE online, players must first put up a refundable deposit for creating a contract or listing an item for sale. To create a sell or buy order, players must also pay a 0.9% broker fee on the order price of the item. There is also a 1.5% sales tax on any sale, which is not refundable.<sup>45</sup> Corporations within the game must also pay certain taxes. Guild Wars 2 features a non-refundable listing fee of 5%, in addition to a 10% tax on completed sales which is automatically deducted from the seller's profit.<sup>46</sup> Players that are not careful can sell items near the vendor price, which means that the tax makes them actually lose value in the item relative to the price they might obtain from selling it to a non-player character within the game. Team Fortress 2 does not have an auction house, so it doesn't have any in-game transaction fees to speak of with the player-driven economy. However, players that live within Washington and wish to buy anything on Valve's store incur sales tax, in addition to those who buy from Arenanet, as both are based in Bellevue. One point worth making is that the auction house doesn't quite create wealth in the same manner as selling to the server or finding items from adventuring; it is merely redistributing currency amongst players and at a taxed rate as well.

Two more mechanisms present in GW2 are travel costs, and an in-game code to reduce incentives to farm extensively. When worlds can take several minutes, and perhaps even hours to traverse due to their size, developers begin to implement teleportation or mechanisms of

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<sup>45</sup> EVE Online Wiki, "Market Guide", [http://wiki.eveonline.com/en/wiki/Market\\_guide#Selling\\_instantly](http://wiki.eveonline.com/en/wiki/Market_guide#Selling_instantly): (6-5-2013).

<sup>46</sup> Guild Wars 2 Wiki, "Trading Post", [http://wiki.guildwars2.com/wiki/Trading\\_Post#Fees](http://wiki.guildwars2.com/wiki/Trading_Post#Fees) (6-5-2013).



travelling faster. Buying into these mechanisms typically incurs the player some marginal fee each time they utilize it. In Guild Wars 2, the developers have created a system to allow players to teleport to various locations that they have discovered, for some small and elastic fee that depends on the player's level. The higher level characters with more currency pay more to travel. Each time a player travels incurs the relatively small fee, but repeatedly travelling can soak an adventurer's wallet quickly. The game also features a piece of code that reduces the item and financial rewards a player obtains for sitting in the same area and "farming" the creatures in the area, a very common behavior in other games for players that want to obtain mass amounts of one item. Instead, after a certain time period, Arenanet has designed the game to reduce the drops given to players, up to a point where the player's efforts are no longer warranted by the rewards given. This is done to prevent too much of an item entering the economy, but also to just disincentive what many consider a boring task.

Repair costs are a very common way for developers to take currency out of the system. Typically, items with more value and higher levels possessed by players lead to greater repair fees that must be paid by players. In Guild Wars 2, a player's activity in fighting monsters, or in dying incurs damage to their equipment, and equipment that runs out of durability must be repaired or otherwise no longer contribute to the strength of the character. Thus, one is forced to actively repair their equipment, which is typically done by approaching the appropriate non-player character that repairs equipment for a linearly increasing fee based on the level of one's equipment. Any money spent with non-player characters effectively vanishes from the game's economy. With EVE online, players must pay to repair their ships when they have been damaged from combat with other players, or otherwise risk potentially losing their onboard



cargo and having their ship be destroyed. If their ship is destroyed, then they lose the value of it, their cargo, and potentially significant investments in their player's skills that they have made.

General fees and items within the games that eat up a significant portion of currency within games are a very common way of throttling the increase of the money supply. Again, this does not apply to Team Fortress 2. These fees may be in order to purchase new skills or recipes, or goods and services from non-player characters that are required for a player to continue to progress their character. For instance, Guild Wars 2 has fairly expensive in-game "tomes" that allow the player's character to unlock greater access to skills within the game, and EVE has very expensive blueprints that grant players the ability to construct valuable in-game capital, primarily for capital ships within the game. EVE actually maps out the balance of sinks and faucets within the game, and it's obvious that the sinks are not sufficient in preventing significant monetary supply growth (**figure 4**).<sup>47</sup> The money that flows into the economy outweighs the money that exits to a large degree.

To speak again on a topic involving Team Fortress 2, some difficulty is presented in reducing inflation within the game that doesn't have an explicit currency per se. Thus, the main ways by which the developers prevent inflation within the game involve relying on player's gambling away currency (metal), and making sure that another is consumed when it is used and thus exits the market (keys). With the gambling part, because of the large amount of scrap that can enter the economy, Valve has instituted a system that allows players to essentially craft together 3 pieces of refined metal in order to have a chance at obtaining a randomly

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<sup>47</sup> CCP Games, "Quarterly Economic Newsletter: 4<sup>th</sup> quarter 2010", [http://cdn1.eveonline.com/community/QEN/QEN\\_Q4-2010.pdf](http://cdn1.eveonline.com/community/QEN/QEN_Q4-2010.pdf) (6-5-2013).



determined hat. It is often the case that the hat they receive is worth less than the metal, so it's a way to reduce the overall supply of that currency and in effect take value out of the economy. Guild Wars 2 has a similar mechanic with its Mythic Forge, which allows players to smelt together items, forgoing any potential profit earned from vendoring (selling to non-player characters) them or selling them on the auction house, in hopes of obtaining a rarer item. The chance for doing so is low, so the gambling mechanic helps incentivize players to take the raw deal and hope for something profitable to come out.

There are numerous other money sinks in these games of various kinds- ranging from items that become attached to your account and no longer resalable to other players, cosmetic items that are applied to armors or weapons that cannot be removed or resold, or simply items offered by non-player vendors. However, the most interesting money sinks all belong to EVE online. A particularly interesting one is the insurance system in the game. The insurance system "is intended to act as a cushion to ship losses incurred through normal gameplay, be it the end result of a good night's PvP {player vs. player} or due to a PvE {player vs. environment} mishap."<sup>48</sup> These insurance policies are also weighted on the value of the ship a player controls- "Platinum insurance pays out 100% of a ship's base mineral value and the policy costs 30% of that amount for three months of coverage. The intent with insurance is to reduce the cost of losing a ship by around 70%, depending on the price paid for the ship". For some time, players noticed that a ship's market value from the insurance payment actually outstripped the cost of creating and insuring it. Thus, players began to construct, and then destroy ships and profit off of the process due to the improperly constructed definitions of value for the ships by the

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<sup>48</sup> Brendan Drain, "EVE Evolved: EVE Online's not-so-free market", <http://massively.joystiq.com/2010/07/25/eve-evolved-eve-onlines-not-so-free-market/> (7-25-2010).



developers. The developers changed the price used in their calculations to determine the payout to be lower, which then caused prices to drop and adjust to the new value of the ship.<sup>49</sup> The lesson in the end is that EVE players are exceptionally good at exploiting the economy and getting around in-game measures to prevent them from profiting.

## Supply and demand within the games

Just as within real life, supply and demand are driving factors for quantity and at what price items are provided at. All things held equal, a product with limited supply and high demand will feature a high price, whereas a product supplied in excess of demand will feature lower prices. Economists frequently use the parlance of “supply and demand” when speaking to the layperson, but it is frequently misunderstood by the general public. The terms are not just buzzwords, but are concepts used to predict the economy’s response to various factors and events in the world. The most common way to depict the manner by which the economy responds to various events is called a supply schedule. Quantity is measured on the horizontal axis, and price on the vertical axis. In macroeconomics, supply and demand are discussed in aggregate terms, meaning the entire economy or the particular sector in aggregate. Aggregate supply is a line that rises from the origin that measures total supply of products by firms, as it’s relatively common sense that a supplier would generally supply more product when the price is greater, whereas they would provide less when it is worth less. On the other hand, demand is a line that starts out high and goes down from the origin, as consumers are willing to buy more of a product when it is at a lower price, but less willing to buy the same quantity as the price of an

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<sup>49</sup> <http://massively.joystiq.com/2010/07/25/eve-evolved-eve-onlines-not-so-free-market/>



item increases. Economists often make a set of assumptions as to what the economy looks like, so they can more easily discuss economic events. One of the most important is the assumption that the economy is in equilibrium; that is, that there is a matching level of supply at a given price to a level of demand at that price.

There are numerous types of events that can shift one or both of the curves, leading to prices and quantity changes in the general economy. For instance, “a positive, or beneficial supply shock raises the amount of output that can be produced for given quantities of capital or labor. A negative, or adverse supply shock lowers the amount of output that can be produced for each capital-labor combination”.<sup>50</sup> Some examples of positive supply shocks in the real world include “changes in the weather,” “inventions or innovations in management techniques that improve efficiency,” or “changes in government regulations”.<sup>51</sup> A shift in demand without quantity responding accordingly generally means that prices may jump or fall for a new given quantity demanded.

Historical examples of supply and demand shocks abound; during the Great Depression there were many causes that contributed to a massive downturn in the economy. Some of these include the manner by which demand essentially plummeted when people lost significant parts of their income, and net exports fell steeply after a massive increase in protectionist measures across the world. More contemporary examples include the general effect from an increasing level of wealth and reduction in the United States, which has led to an increase in overall aggregate demand and a boost in the economy’s strength over the years. Hurricane Katrina’s impact on the price of oil, after it damaged various oil rigs in the gulf was quite

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<sup>50</sup> Andrew Abel, Ben Bernanke, Dean Croushore, *Macroeconomics* (Boston: Pearson Education, 2011), 66

<sup>51</sup> Abel, Bernanke, Croushore 67



noticeable as well; the price of oil jumped after the supply was substantially temporarily reduced, until President Bush released a significant amount of barrels from the Strategic Petroleum Reserve.<sup>52</sup> Gas prices also tend to be at their highest in summer, when demand is highest and everyone desires to be driving around.

There are abundant instances within each of the games that resemble supply and/or demand shifts within the economies of the games. Many in-game events are parallel to those that occur in real life, and others that require a little stretching of the imagination in order to liken them to how they occur outside of the games. First of all, one of the most common shocks to a video games' economy is an update or a patch to the game, which can have numerous effects from different angles. These patches usually promise new content, and with new content often comes new items, recipes for crafting, and new places for your character to explore. This tends to create new demand for various items within the game, and introduce more of them as well to be traded. Second, an increasing population of a game, whether or not each night when people return from school or work, or during the summer when more kids are playing all day, tends to drastically change supply or demand. Third, exploits or rule breaking among players may also cause a large shift in the game's economy from sudden excess supply or devaluation of an item. Fourth, a change in the way that the developers regulate the game, usually with regards to the ease by which certain items are obtained and shift expectations within the market. Finally, player behavior in general is a final more general means by which supply or demand may be changed. Next, each of these examples as they appear in games will be briefly discussed.

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<sup>52</sup> Council on Foreign Relations, "*Katrina and Oil Prices*", <http://www.cfr.org/economics/katrina-oil-prices/p8834> (6-5-2013).



Updates are one of the most frequent factors that create visible changes in both normal and aggregate supply and demand in games. These updates appear in universally every online game, and include varying levels of content for players to tackle. They may range from dungeons, which may stimulate the needs of players for food or materials to boost their chances of success, which then generally boosts prices of commodity items and potions within the game as more players both demand and supply these items. In other cases, these content patches may simply introduce new items that require certain older ones to create, resulting in substantial increases in the price of an item relative to one another. This is particularly obvious within Guild Wars 2, when the developers of the game decided to introduce a new seasonal event within the game to mark Halloween, which included various new activities and potential crafting recipes for players. Before the event was released, the magazine *PCGamer* received a sneak peek at game content which showed some of these potential crafting recipes.<sup>53</sup> One of the ingredients for the recipes was revealed to be an item called Sugar Pumpkins. Looking at the long term price of the item, when the event started on October 22nd the price had already been rising, but it immensely grew on the day of the preview, rising to 1 silver and 3 copper on the trading post from the previous day's price of 66 copper.<sup>54</sup> However, the price fell precipitously to about 26 copper several days later as players most likely switched away from buying the item, farmed it themselves, or simply obtained as many as they had wanted. Further, in games like Team Fortress 2 when new weapons are released, players tend to try to rush to obtain them so that they may experiment with them in gameplay. The relative value of

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<sup>53</sup> PCGamer, "Guild Wars 2 Halloween Update Hands On", <http://www.youtube.com/watch?v=u4QM57ri8fE> (6-5-2013).

<sup>54</sup> Guild Wars 2 Spidy, "Sugar Pumpkins", <http://www.gw2spidy.com/item/12538> (6-5-2013).



these items is unknown, so players engage in a significant amount of trading when new items are introduced. This is apparent by the trade volume graph diagram included in the appendix (figure 5), which shows a large level of opportunities for arbitrage during influxes of items and more volume in overall trades.

The overall player population in these games, representing in this world both independent firms and individual consumers, are particularly obvious influences on the supply and demand of prices. Guild Wars 2's economist notes that supply on the trading post can often cycle 4-6 times a day, so it stands to reason that some of these prices are particularly responsive, especially during the day, to the ebbs and flows of active characters.<sup>55</sup> Anecdotally, games tend to become more active during the summer and during the winter, when more people receive the software as gifts or are out of school for a period, which can lead to shifts in goods supplied and demanded. More new players in games typically means the prices of lower end items will be depreciated, as there will be a lot of excess supply but not necessarily as much demand while they are still new characters. Certain periods of the year also feature seasonal promotions or events by the games, such as in-game holidays marking Christmas or Halloween, and offer incentive via "achievements" for players to unlock as a form of carrot. These then typically draw players to log onto games at least long enough to complete them, and perhaps draw them into the game after some absence due to the time-limited nature of these sort of events. As noted earlier, this can lead to sharp increases in demand for certain in-demand items, and excess supply in others that are easily obtainable by players.

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<sup>55</sup> John Smith, "Economy Statistics", <https://forum-en.guildwars2.com/forum/game/bltc/Economy-Statistics/page/4#post1220259> (6-5-2013).



It is also noticeable that the price of gems relative to gold in Guild Wars 2 has mostly been rising over time, which possibly suggests that as more games are being sold to people who then begin playing the game, there are more demand for the near-essential gems within the game. Daily fluctuations of the Guild Wars 2 economy from somewhat predictable population changes seem relatively common throughout most of the items being sold. For instance, the average price of gold rises through the day, but generally seem to reach its lowest exchange rate at around 8-10pm for the day.<sup>56</sup> Since gems are only supplied by other players on the marketplace, and not directly by Arenanet, the supply and prices derived from demand depend on the activity of players. The economy is fed by every server, but this time of day might be particularly relevant to the game's largest area of player's time zone. This effect is not true for all items, and some don't seem to experience it as much, particularly in the case of more rare and exotic items. Commodities seem to have the most commonly changing prices, and at sometimes different times each day. Late in the night or early in the morning are common times for prices to be at their lowest. Anecdotally, weekends are prime times for prices to be at their most unpredictable. At the same time, with the greater amount of money introduced in games via additional players, and players that begin reaching higher levels within the game and thus gaining access to more profitable means of gathering currency than beginning players pushes gold's value down relative to gems. Gems started out close to 27 silver per gem at the game's release, and now the ratio is about 3 gold and 20 silver to buy 100 gems.<sup>57</sup>

Third, exploits and contravention of a game's rules are a recurring problem that may often prompt very large supplies of both in-game or out of game currencies and near-

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<sup>56</sup> <http://www.gw2spidy.com/gem>

<sup>57</sup> <http://www.gw2spidy.com/gem>



immediate developer action, as they can destabilize a game's economy. These can take various forms; the most relevant to this project involves players finding an in-game bug that allows them to obtain a near-infinite amount of an item or currency without the checks intended by the developers to prevent such action. In other events, this term refers to making the game easier to play in a way that defies normal game design. Previously in the inflation section, the example of 20% inflation in 24 hours caused by an exploit in Everquest 2 was noted. Recently, a game called Diablo 3, which features an auction house where players can both spend real money on items and withdraw 85% of that money after selling an item, suffered a crippling economic bug. 415 players utilized a bug that effectively allowed them to manipulate the auction house in order to duplicate gold within the game.<sup>58</sup> This caused the value of currency to go down for the several hours the glitch was live, and some players noted prices for certain items radically changed due to the devaluation of currency during that time period.

In EVE online, there was a significant exploit found by the players, and closed by the developers. This exploit resulted in an oversupply for several items required to produce higher end items.<sup>59</sup> After being closed, the prices of these items "subsequently jumped by as much as 100% in the month of January." This then resulted in a diminished production of these higher end items, as well as a diminished demand for the expensive materials. Furthermore, this event happened at the same time a new update containing even higher level items was being showcased as releasing in a couple of months, which further depressed demand for these sort

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<sup>58</sup> John Hight, "Auction Houses Up and Running", <http://us.battle.net/d3/en/forum/topic/8796520380> (6-5-2013).

<sup>59</sup> CCP Games, "Quarterly Economic Newsletter 1st Quarter 2009", [http://cdn1.eveonline.com/community/QEN/QEN\\_Q1-2009.pdf](http://cdn1.eveonline.com/community/QEN/QEN_Q1-2009.pdf) (6-5-2013).



of items as they were becoming somewhat obsolete.<sup>60</sup> This shows the general impact of exploits that cause excess supply of an item relative to what the developers had designed the game to output which are then closed; prices readjust to a new equilibrium in the market.

The problem of botting is also a common issue for these games, as the people in control of these bots tend to lead to prices hitting rock bottom, with a continuous cycle of undercutting normal players' listings on the auction house and devaluing currency. This isn't as much of a problem for Team Fortress 2, because of the typical ability of players to vote to kick botters from servers, the weekly cap on obtainable items per account, and the lack of markets. Because these types of "players" tend to hoard money and items until they can be sold, banning them and thus removing their items and currency from the game can lead to a large change in prices. Companies also typically wait until they have enough data on players using botting software so that they can ban giant waves at once. During November, 2012, Arenanet banned 34,000 accounts for using botting software.<sup>61</sup> A moderate change in prices around the time that a majority of these bots were banned is noticeable; the artificial deflation effect that they have while providing items at lower costs than players ended, and thus prices involving many typically farmed items rose with the reduction of supply until the market responded by selling off more of the items.<sup>62 63</sup>

Fourth, expectations and rarity of items imposed by a game's regulators, the developers, may often act as a significant factor in shifting total supply or demand for an item. Developers often retroactively decide that an item is more easily obtained in the game than

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<sup>60</sup> [http://cdn1.eveonline.com/community/QEN/QEN\\_Q1-2009.pdf](http://cdn1.eveonline.com/community/QEN/QEN_Q1-2009.pdf)

<sup>61</sup> Mike Lewis, "Mike Lewis on the War Against the Bots", <https://www.guildwars2.com/en/news/mike-lewis-on-the-war-against-the-bots/> (6-5-2013).

<sup>62</sup> Guild Wars 2 Spidy, "Vial[s] of Powerful Blood", <http://www.gw2spidy.com/item/24295> (6-5-2013).

<sup>63</sup> Guild Wars 2 Spidy, "Elaborate Totem[s]", <http://www.gw2spidy.com/item/24300> (6-5-2013).



they wish for it to be or in other cases that the item is too difficult to obtain. This is usually rectified by making the drop rate for an item higher by some percentage rate, or perhaps adding additional ways of obtaining an item. When developers announce a change in drop rates in advance, players may take advantage of the chance for making profit, just as might happen with commodity prices in real life.

In EVE online, a certain mineral called Zydrine was particularly rare, but players within the game noticed that they could much more easily obtain it via repeatedly destroying a certain spaceship.<sup>64</sup> This led to behavior by players of farming this item in a previously undiscovered way, which caused the supply to rapidly increase and the price to drastically fall. The developers, without announcing their intent, changed the drop rate for the item on a test server (not the one people actively play on). Players began to expect a crash in the supply on the live server, and proactively started pricing their existing Zydrine much higher in prediction of a new equilibrium price around April 2010.<sup>65</sup> However, after the patch actually went live in June of 2010, Zydrine's price fell considerably at 16% below the previous price.<sup>66</sup> We see these sort of price changes all the time with regards to various kinds of services and products in the real world; whether such as expectations of how the health care bill will affect health insurance providers, or commodity speculators with items like barrels of oil and predictions of how the economy will be doing in several months or years. Recently, when the AP News' twitter was hacked and released a Tweet saying that the president had been injured, the Dow Jones index experienced a rapid shock, which was just based on trader's gut perception of what would

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<sup>64</sup> <http://pc.gamespy.com/pc/eve-online/855380p2.html>

<sup>65</sup> <http://pc.gamespy.com/pc/eve-online/855380p3.html>

<sup>66</sup> CCP Games, "Quarterly Economic Newsletter", [http://cdn1.eveonline.com/community/QEN/QEN\\_Q2-2010.pdf](http://cdn1.eveonline.com/community/QEN/QEN_Q2-2010.pdf) (6-5-2013).



happen to the economy.<sup>67</sup> Such behavior is paralleled by what happens within these games with “bad news”.

Finally, the sort of priorities that players within games, their preferences, and how they behave are large determinants on both the supply and the demand of various items. For instance, there aren't necessarily fungible differences in the value of various particle effects on hats within Team Fortress 2- It is mostly the prestige of certain kind of hats combined with certain types of effects that makes their prices so sky high. Players have a 1% chance of obtaining a type of hat from any particular crate. They then have a 1/31 chance of the hat having any one of the unusual effects.<sup>68</sup> Thus, there is no real reason for prices to be different for many of the hats besides player driven preferences. However, some players have suggested after mining data regarding drop rates for hats that the newer particle effects that have been introduced over time are more commonly found than the classic, older ones. This appears fairly likely anecdotally, as the numbers of unusual hats with certain effects seem fairly skewed, looking at the most popular list of how many unusual hats are in existence.<sup>69</sup> Some hats are simply considered more aesthetically valuable, particularly the Team Captain, which can have a price of over \$4000 when combined with the Flames particle effect. Some unusual hats may be worth little more than 10 dollars at best due to their undesirability, whereas the average lies around \$130 for every effect.<sup>70</sup>

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<sup>67</sup> Julian Hatttem, “Market watchdog: AP Twitter hack shows need for new oversight”, <http://thehill.com/blogs/regwatch/technology/296319-markets-watchdog-ap-twitter-hack-shows-need-for-new-oversight> (6-5-2013).

<sup>68</sup> Team Fortress 2 Wiki, “Hats”, [http://wiki.teamfortress.com/wiki/Hats#Update\\_history](http://wiki.teamfortress.com/wiki/Hats#Update_history) (6-5-2013).

<sup>69</sup> Backpack.tf, “Unusual Pricelist”, [http://backpack.tf/unusuals/611/Salty\\_Dog](http://backpack.tf/unusuals/611/Salty_Dog) (6-5-2013).

<sup>70</sup> <http://tf2finance.com/unusuals/>



It is also important to note the effects of the player base of a game advancing their characters to higher levels, which causes various items to become simultaneously more in demand, and others less in demand. For instance, as players reach the top levels, they begin to have access to new, more expensive items as they are rewarded with more expensive items from completing quests, and have access to greater money making opportunities, much as how older (and wealthier on average than the young) people in real life begin to demand more luxury goods with their greater income. The equivalent to these luxury goods, like a BMW, a mansion, a yacht, or a very nice wristwatch, in the typical MMORPG might be the highest end weapons, armor, and cosmetic items which tend to appear on the market as more players reach higher levels in the game. They are also generally required to be able to participate in increasingly difficult content which tends to demand a better outfitted character in order to succeed. While many players simply race to the maximum levels in order out of sense of personal accomplishment, many proceed at a slower pace.

In any event, when the majority of the player base hits the higher and maximum level and start to be able to use these high end items on their characters, the supply of high end items tends to rise fairly rapidly as players gain access to the higher level areas, crafting recipes, and dungeons from which they are obtained. After the initial burst in supply, it tends to then slow down, whereas demand appears to be more flexible. This is particularly obvious in Guild Wars 2 while measuring the prices of very high end weapons. These weapons have experienced very large increases in price, especially several months after the games' release. For instance, a very high end and desired weapon called "Infinite Light" has experienced a somewhat steady



increase in price since the game's release.<sup>71</sup> On the other hand, a legendary quality weapon called "Bolt" has featured a somewhat flat price since appearing in the game December 2012, so this trend may not apply to the absolute highest end items which are always exceptionally scarce, have various sunk costs pinning the prices up, and are heavily in demand.<sup>72</sup> Mystic coins also saw a steady increase in price as players realized their utility in the creation of legendary items in the game, rising from less than 5 silver per unit to above 10 for a period of several months (**figure 6**).<sup>73</sup> When a player can need to obtain 100 of these to craft high end items, the price increase is quite noticeable.

## Elasticity

Elasticity is a frequently discussed topic in economics, and one that is present in the real world as well as those that are virtual. The concept of elasticity at its core discusses the change of one variable, typically price, will change the supply or demand of a product. There are various kinds of elasticity, some measuring the responses of producers to different prices and of returns to scale, and others measuring the responses of consumers to different incomes, prices of goods, and changes in the price of one good on another. Economics also indicates that some goods are elastic or inelastic with regards to prices, elastic meaning consumers or supplies will respond to changes in the price of an item, and inelastic meaning they will not respond much in terms of their quantity produced or demanded if prices are changed one way or another. An example of an elastic good might be a commodity. An example would be a small farmer trying to sell their wheat at 30% higher than every other seller. This would have very

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<sup>71</sup> Guild Wars 2 Spidy, "Infinite Light", <http://www.gw2spidy.com/item/31068> (6-5-2013).

<sup>72</sup> Guild Wars 2 Spidy, "Bolt", <http://www.gw2spidy.com/item/30699> (6-5-2013).

<sup>73</sup> Guild Wars 2 Spidy, "Mystic Coin[s]", <http://www.gw2spidy.com/item/19976> (6-5-2013).



little effect on the market, and because there are enough substitutes i.e. you can go find another farmer to sell his products for the market rate, this farmer's wheat would likely go unsold because there isn't similar demand for it above market prices. At the other extreme, an inelastic good might be insulin. A more inelastic situation might be a company significantly raising the price of insulin that they sell to diabetics; from a health standpoint, many diabetics cannot go without insulin and be healthy, and so they would likely pay a much higher price if necessary to maintain a similar quality of insulin and their health. Perfectly inelastic would mean there would be no response by anyone to price increases or decreases, and perfectly elastic would mean that any price change would prompt everyone to stop purchases of a product. Some more commonly discussed inelastic consumer goods and services might be necessities that have no substitutes like water, electricity, surgery, and perhaps gasoline to some extent. A more elastic good might be one with a lot of substitutes- if Starbucks significantly raised the price of their coffee, people might switch to brewing it at home, or frequenting other establishments that serve roughly comparable products. Whether or not an item has substitutes generally has a large impact on the potential elasticity of the good. In these video game economies however, the dynamics of these game's designs allow for a substantial amount of substitution in goods, which in turn leads to a degree of elasticity within the game with prices of certain items.

Some of the ways by which a game's design might allow some degree of substitution is the nature of how crafting works in these games, the design of how weapons and items work in the game, and the nature of how the auction houses function within the games. With regards to the crafting system, products created are generally homogenous in EVE and TF2, but only up



until a point in GW2. In EVE, items have a set recipe and outcome, and with TF2, excluding unusual effects and the chance at randomly crafting hats, every crafted hat is identical to others of the same name. Items being created have a chance at a semi-random set of “stats” (i.e. bonuses to certain character strengths and traits), which may make them more or less useful to certain classes within the game that are benefited more from stats than others, i.e. a wizard needs intelligence, a warrior needs strength, etc. Another point that’s important to notice with substitutability in these games is that unlike in real life, a manufacturer cannot decide to switch from corn syrup to sugar or vice versa in their soda recipe when one price changes significantly. Players are stuck using the recipes in the games as the developers designed them. However, consumable items, food or potions or the like, generally have varying effects with varying prices, so players that sell the in-demand ones at a higher price may receive it, but less-in demand and less high end items are much more interchangeable, so their prices are much more static. However, players might choose to shift to another profession if one’s reagents are too expensive. They may also choose to try to attempt to craft an item that doesn’t use a certain ingredient, which applies in the cases where they are trying to level a crafting skill.

Usually, there might be some common ingredients in between recipes, but in Guild Wars 2 some of the different types of ingredients for lower level recipes fluctuate relative to one another and do not have the same price. They may also have some variable difficulty of being obtained, but some roughly equal in utility within the game- Vials of Weak Blood, Tiny Totems, and Tiny Claws all feature significantly different prices despite being roughly equally useful in early crafting recipes. Vials are bought for 25 copper, Tiny totems 29, and Tiny Claws

22.<sup>74</sup>,<sup>75</sup>,<sup>76</sup> Their prices are likely tagged together to some extent, as any rapid price movement in one would prompt a switch to another ingredient. This switching of professions usually comes at a cost to players, much as it might in real life; In Guild Wars 2, players may have 2 of 8 crafting disciplines active at any one point, and may switch to another at a cost of 10 copper per level they have obtained, which maxes out at 400 for professions within the game. There is a more significant opportunity cost for switching to a different sort of crafting pathway in EVE in that you don't have prior progress, but you may choose to switch and work on a new pathway. It's also important to note that

Weapons and armor, and other related items are also subject to substitution at a player's discretion. While there might be a "best" set of stats, players usually have the option of choosing the second best, or a product that is several steps down in quality or in level. These products are usually substantially cheaper, and only contribute a small fraction less to the strength of a character in the game. The top weapons in the game are worth somewhere in the hundreds to thousands of gold, but several steps down and prices start to resemble sub-30 gold for many products. These top items are also valued for their specific cosmetic appearances, which the developers have made fairly specifically the "best" looking in the game and not quite substitutable by other at the same level for appearances. Below that top cosmetic tier though, there are a substantial amount of these slight downgrades, or even "side grades" depending on the specific statistics a player values on a piece of armor for their character. As the Guild Wars 2 economist notes, "Especially when it comes to stats, I can change rarity, type, order of stats in a

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<sup>74</sup> Guild Wars 2 Spidy, "*Vials of Weak Blood*", <http://www.gw2spidy.com/item/24290> (6-5-2013).

<sup>75</sup> Guild Wars 2 Spidy, "*Tiny Totems*", <http://www.gw2spidy.com/item/24296> (6-5-2013).

<sup>76</sup> Guild Wars 2 Spidy, "*Tiny Claw[s]*", <http://www.gw2spidy.com/item/24346> (6-5-2013).



myriad of combinations with less than a 1% change in my total effectiveness. Switching to corn syrup causes significantly more than a 1% change in a product.”<sup>77</sup> Besides the players that are driven to make their characters the best as possible (which is a significant portion of them), others are free to not try to optimize their characters as much and take a more relaxed attitude to the game, perhaps corollary to real life where some people may demand Mercedes and Ferrari vehicles and be willing to pay for increased performance, whereas diminishing returns to car quality might arguably kick in fairly heavily at \$40,000 (or somewhere in that range).

Finally, the nature by which these markets work also serve to enforce a form of elasticity by offering a large degree of choices from buyers, as well as the way by which these markets present prices to the consumer. With EVE and GW2, players are presented within the game the prices and some trends in pricing for every item when they use the auction houses, and so can see the going market rate. They can also see current listings for sales, and thus can easily compare amongst suppliers’ prices for items. This becomes important, as with the exact same item, there is literally no reason to buy from anyone but the lowest buyer on a market, as goods of the same name are homogenous in these markets. Additionally, these markets are often very large in the low-end or very common goods and cannot be monopolized easily and relisted to a higher price, as it’s very easy to obtain these goods with little time and effort for players sick of exorbitant prices. If a player sees 1000 instances of a commodity being sold for 500 ISK, and 5000 instances of it being sold for 1000 ISK, because the auction houses in EVE/GW2 are anonymous and global players are irrational to do anything but buy from the lowest cost supplier. Players typically know that they can just buy from the lowest bidders

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<sup>77</sup> John Smith, “*The Sinister Market Manipulator*”, [https://forum-en.guildwars2.com/forum/game/bltc/The-Sinister-Market-Manipulator/page/2#post1281329\\_\(6-5-2013\)](https://forum-en.guildwars2.com/forum/game/bltc/The-Sinister-Market-Manipulator/page/2#post1281329_(6-5-2013)).

repeatedly, especially when the behavior of most players is to undercut the current lowest sale price on an auction house by about 1% or so. This is especially true with commodities within the games, which are sold in massive volumes and have large amounts being sold at each relative price point within the game. With a game like Team Fortress 2, the market is supplied a substantial amount of information from various websites, which feature such large portions of player's exchanges that they serve to set prices in the market that players are loathe to deviate from. When websites like scrap.tf offer automated trading for players to buy/sell their items at fixed rates and do so in bulk with their website, this serves to set somewhat rigid prices for more established/older items.

## Other Interesting Comparisons

### Major similarities

This paper has described various ways by which these games resemble the real world, varying from the way by which these games may suffer from inflation, from supply and demand shocks, and exhibit some form of elasticity in demand. However, there are a variety of other very interesting ways in which these game economies both do not resemble real economies in very critical ways, but also further ways in which they do resemble real life that have not yet been investigated within this paper. There are differences that are, to some extent, caused by the differences in reality relative to what the medium of a game imposes on possible virtual worlds. Some of the differences may complicate analysis of these games in the long run, when attempting to translate lessons from them to the real world.



First of all, the markets of the games feature developer-imposed scarcity; as these games are essentially just data points stored on servers, players could, without a set of rules preventing them from doing so, essentially have unlimited resources. This would remove the nature by which it resembles a world with somewhat scarce resources. In reality, there are a limited amount of resources accessible, and while we may develop technology that allows us greater access or the ability to change the state of various resources, we're never going to gain more resources without bringing them in from space. Much of what determines the price of a commodity like oil or gold is its rarity, and difficulty in obtaining it. Scarcity in supply is a critical factor with regards to how prices are determined, and prices and cost factors in the quantity supplied of a good. In a virtual world, when there aren't typically substantial sunk costs to obtain commodities, some element of scarcity must still be imposed to maintain similarities to the real world. This is typically done by having set drop rates for items, placing nodes of resources in dangerous and high level areas, restricting the spawn rate of these sorts of items, and requiring a certain level of a crafting skill to be able to mine or harvest commodities. Outside of consideration of just commodities, however, items like armor may become bound to a player's account upon usage, preventing further trade of that item, or may become used up and thus destroyed, again removing them from the market.

Players are also granted a significant amount of information about prices, and some might even say a superior level of information due to all of the in-game and out of game resources driven by both the developers and players of the games. Guild Wars 2's economist notes, "there is imperfect information, but there is significantly less imperfect information than the real world. There is also less market failures associated with imperfect information because

of homogeneous goods.”<sup>78</sup> EVE’s economics team offered quarterly economy reports until a couple years ago, but they still provide yearly reports and strive to maintain the perception and existence of their game as a laissez-faire economy. In the real world, we can look to Bloomberg, CNBC, or various industry measures of commodities, indices, and so on to watch and predict trends in the economy. People make their decisions on how to behave in virtual worlds based off of information much like one would in real life. Speculation often results after players get wind of a patch that explicitly changes or is rumored to change some important aspect of the economy, and act accordingly. Information may also be flawed- many of the figures in this paper have come from figures derived from analysis of the in-game economies by third party websites like GW2spidy and TF2finance. The developers of games often provide substantial but still limited data to players, who resort to writing programs that can assess the value of in-game items and the volume by which they are traded by scripts written to scrape the economies. The developers of GW2 have their economy accessible outside of the game and EVE allows players to scrape it within the game. TF2’s developers don’t have publicly available records of the economic transactions, but 3<sup>rd</sup> party websites, due to their volume of facilitated trades, are able to provide some guess as to the value of items.

Players may also choose to specialize in a various profession or class within the game, and there is little stopping them from doing so. On a player class level, people may choose to be warriors, thieves, or magicians in a game like Guild Wars 2. On a profession level, one might choose to specialize in creating potions, baking, or in crafting weapons. It is also possible to

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<sup>78</sup> <https://forum-en.guildwars2.com/forum/game/bltc/The-Sinister-Market-Manipulator/page/2#post1281329>



choose to solely play the markets of a game and not engage in any combat, whereas many people choose either to fully do combat or to mix the two. While these games typically force you to stick to a class when you choose it, you can choose to create a new character within the game with a new class, or switch professions at some cost. In real life, one might have to worry about skills and licensing preventing one from switching between jobs. In games, you don't have such a barrier preventing you from learning new skills, as games are much faster paced than real life and allow rapid switches as one fancies. One might choose to switch professions or classes and re-level them quickly if they wish to do so. On another note, there are elements of labor mobility in games like in real life. People may choose to enter most labor markets or exit with probably greater ease than is possible in real life; one might decide not to play the game one day, or could decide to play the market one day and not engage at all with it the next. Labor is also fairly mobile within the games, as players can generally travel throughout the map of a game without exceptional burden. They, however, cannot leave the world that they are tied to, i.e. they cannot move a character within one game to another.

These games can also feature forms of economic growth. EVE in particular has been able to show how its population and increase in supply of items and currency has contributed to various changes in the strength and size of its economy, such as how trade value per region has changed over time. Depicted on the graph in the appendix (**figure 7**), one can see how through time the value of trade has increased for various reasons, including market growth and general population increases.<sup>79</sup> Looking at the GDP (gross domestic product) of the U.S. over time, one can easily draw the same conclusions over how the size of our country's economy has grown

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<sup>79</sup> CCP Games, "Quarterly Economic Newsletter 4<sup>th</sup> quarter 2009", [http://cdn1.eveonline.com/community/QEN/QEN\\_Q4-2009.pdf](http://cdn1.eveonline.com/community/QEN/QEN_Q4-2009.pdf) (6-5-2013).

over time. Some have even made the effort to determine the GDP of online games. In one such effort, researchers gained access to 314 million transactions from Everquest 2's economy, and were able to construct an exchange rate between the virtual and real currency. They found that "the real GDP of one of the servers was between \$11 and \$14 per registered user per month (\$130-\$164 per year). In the real world, that puts the average EQII player on par with citizens in developing nations such as Liberia, Congo, and Burundi."<sup>80</sup>

Finally, one issue that arises in games in addition to games is the problem of identity theft. In games, the problem is more of people hacking accounts in order to gain access to belongings, and entirely liquidating the belongings of the character and turning into gold, which is then sold to other players for cash. In real life, a variety of uses of one's identity for illegal reasons are possible, like stealing from their bank accounts (which might be a closer parallel), stealing a social security number (not relevant), or taking out a lot of debt in their name (which isn't really possible). Governments both in real life and in games punish those who engage in such behavior, whether by banning accounts and internet addresses of those found guilty in games, or by jailing and fining them in the real world. However, measures to prevent such activities can only be so effective, and fraud generally occurs at some rate regardless of how much the government or developers try to stop it.

## Major differences

There are some critical differences with the economic environments and functions of these games. One such driving cause of such differences is the nature of the medium. Games,

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<sup>80</sup> Jenny Leonard, "Virtual economies mirror the real deal", <http://www.futurity.org/society-culture/virtual-economies-mirror-the-real-deal/> (6-5-2013).



at least for the foreseeable future, are unable to be as complex as real life with its dizzying amount of possible variables in every area. Graphics are still limited due to storage space on computers, and the possible time that can be spent on designing any one game and get it out to the market in a reasonable timeframe is also limited. The input methods are still limited at this time to keyboard and mouse, whereas a virtual reality game might allow a more realistic medium. Further, the sort of game that developers can make and also have it sell is limited; players don't usually want a game that functions as a job, so if it gets too realistic or burdensome it might not attract enough players to sustain its existence or investors to pay for it. This then limits how similar a game can be to real life. There are also other ways by which the medium prevents total congruity between games and reality.

One such critical difference is that there is basically an infinite amount of resources that can be possibly acquired in games. These games can still endlessly reproduce resources to some extent based off of player activity, whereas our Earth is likely stuck with what is on it resource wise. We may act as though we have an infinite amount of some resources like air, but it's conceivable that we might sully our air too much for it to be breathable, and we are already running out of gases like hydrogen. One popular blogger who writes about virtual economies argues that they are "upside down" from those in reality, because "in a virtual world the economy starts with little (if a seed is provided) or no (more typical) resources and all economic currencies increase rapidly over time, approaching infinity if the world is not properly designed with resource sinks."<sup>81</sup> As these games can never truly run out of a resource (most of the time), this causes different decisions to be made and different behavior. These games also feature

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<sup>81</sup> Ramin Shokrizade, "Guild Wars 2 Economy Review", <http://www.gamasutra.com/blogs/RaminShokrizade/20130426/191346/> (6-5-2013).



glitches and bots that farm currency; while our world is no stranger to fraud and duplication of currency, it's difficult to create an exact parallel. They take advantage of the possibility for an infinite amount of items to be created. As it is impossible to create corporeal items out of thin air in real life, this is a problem foreign to reality.

On a similar note, the stakes regarding decisions are lower in these games, and that seems likely to change player's behavior. No one is going to become unemployed, lose their house or retirement, and so on, and this posits the question of how radically people's behavior will change when their decisions will likely not change anything more than virtual games and their mood in real life. It would seem logical that people not facing permanent death, disfigurement, or the ability to relatively easy start their in-game lives over would make substantially different decisions with regards to how many risks they might be willing to undertake, what goods they buy, and how they treat other people. For instance, they might be more willing to take near-suicidal actions with their character in hopes of financial gains, as you might respawn for a nominal fee or only suffer minor financial harm, if any. Such actions are taken in the real world by only those that are insane, yet it might be relatively commonplace for players within a game to try to earn some sort of reward but expecting death much of the time, and repeated deaths before finally conquering some boss in a game. This would seem to then complicate the parallels that can be drawn between the behavior of actors in a virtual world and ones in the real one.

In addition, as EVE's economist notes, unemployment is not possible in EVE (and in many such online games), since "all pilots, even those that have lost it all and have minimal



entrepreneurial skills, can start again with what matches a bucket and shovel in real life."<sup>82</sup>

There are few parallels to be made- players can technically log into a game and not engage in any economic activity, but they don't really suffer from starvation or lose their homes if they don't do so, and players can make even minimal amounts of money instantly by going out and whacking some monsters or completing quests. Players who simply don't log into the game might conceivably count as unemployment within a game, but that also doesn't seem quite legitimate, as players logging in could instantly become employed, and every player is in effect self-employed at whim. Unemployment is one of the biggest macroeconomic problems in the real economy, and so for it to be essentially a non-factor would seem to be one manner by which analysis might be complicated.

Finally, these games also do not allow trade between games and different currencies- every game is, in essence, a totally closed economy. It is impossible without contravening the mechanics of the game to switch gold from one game to another, as they do not talk to one another. Loosely, if we were to consider each country a world that has its own currency, it's possible to switch between them without an abundance of trouble most of the time. That might be an unfair comparison, as a server is effectively a world and a country is just a component of the world. Now, players may be able to do things like sell currency, items, or their accounts for dollars outside of the game and then put that money into another game, but those actions are generally discouraged if not prohibited by the developers of these sorts of games. This limits the sort of inter-currency trade we see on a daily basis in reality.

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<sup>82</sup> [http://cdn1.eveonline.com/community/QEN/QEN\\_Q1-2009.pdf](http://cdn1.eveonline.com/community/QEN/QEN_Q1-2009.pdf)



## Conclusion

The games delved into by this paper, Guild Wars 2, EVE Online, and Team Fortress 2 offer various economic parallels to reality. These parallels offer various opportunities for those able to devise an interesting thesis that might be tested by the massive amount of player interaction and data present within these games. Questions that aren't able to currently be proven, such as if Giffen Goods exist (ones that people consume more of as the price rises) might be finally answered by closely investigating the sales of items. They might also be able to examine the rationality of consumers, various topics in behavioral economics, and so on that might be difficult to see in reality. Economists might have the potential to experiment within the games beyond simply just reading the data, if they can gain permission from developers and create it in such a way that it doesn't drastically impact the player's experiences within the game. They may be able to conduct the sort of economics experiments that might shed significant light on real world problems or topics that are difficult to investigate due to the obscurity or difficulty in collecting data.

As Dr. Varoufakis says, we run into certain failures in designing economic experiments; we might run into "absurd conclusions such as 'Christmas is explained by a prior increase in the demand for toys'". He says, the reason for these sorts of failures is "our inability to run experiments on a macroeconomy such as rewinding time to, say, 1932, to see whether the US would have rebounded without the New Deal (or to 2009 to see what would have happened to the US economy without Ben Bernanke's Quantitative Easing)". In contrast, "digital economies



are a marvelous test-bed for meaningful experimentation.”<sup>83</sup> Of course, while viewing games as a source one must be careful to not ignore any of the many and significant differences between real life and games when conducting experiments. However, one might easily consider the possibility that an economist might someday use experimental data derived from a game to predict a recession in real life, or perhaps be able to suggest actions to avoid or mitigate one. In short, the medium offers many opportunities for those willing to take advantage of them, as long as they carefully build any experiments or observations around the differences in the medium.

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<sup>83</sup> <http://blogs.valvesoftware.com/category/economics/>



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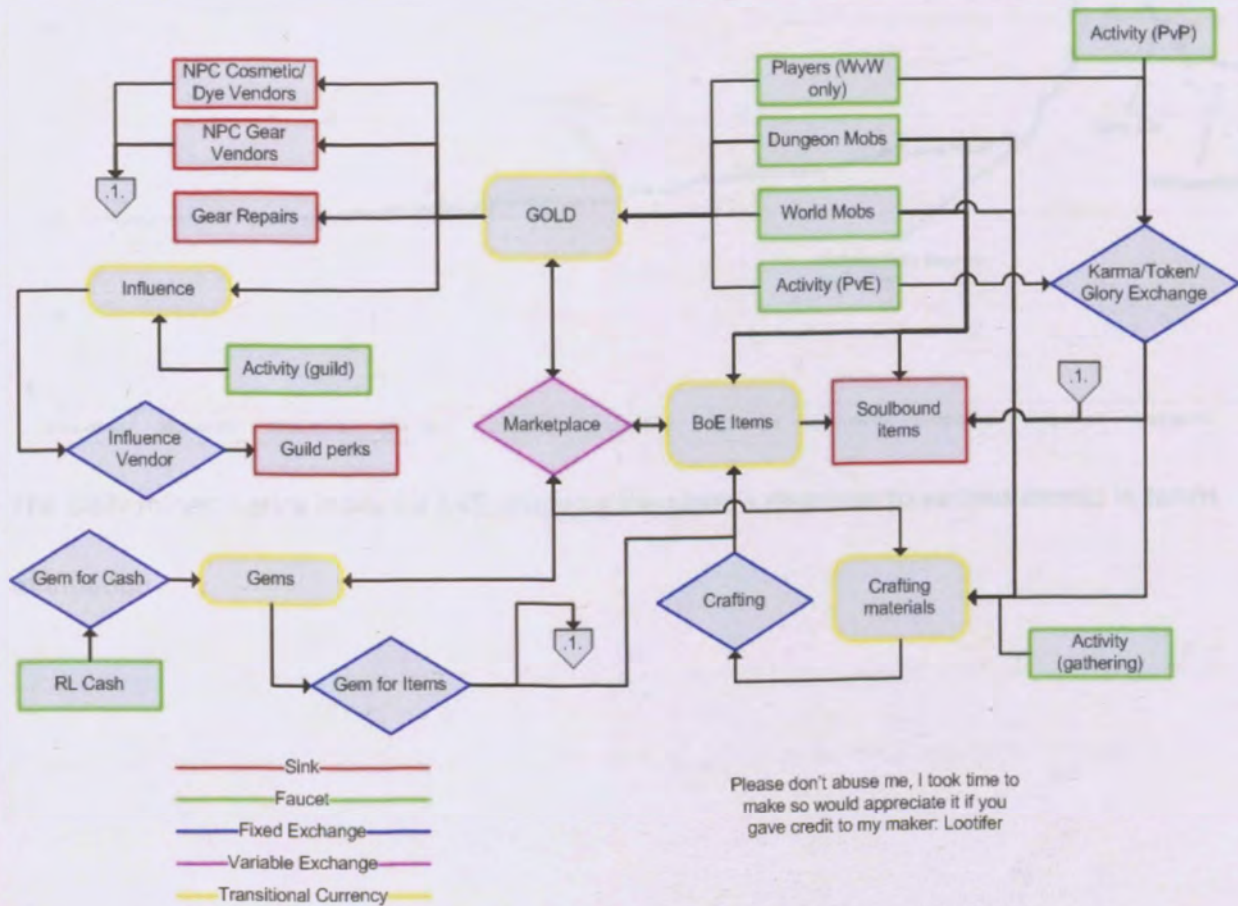
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## Appendix, figures

Figure 1



<http://i299.photobucket.com/albums/mm282/btu10/GW2Economy.jpg>

A community made depiction of the typical marketplace of the Guild Wars 2 economy.



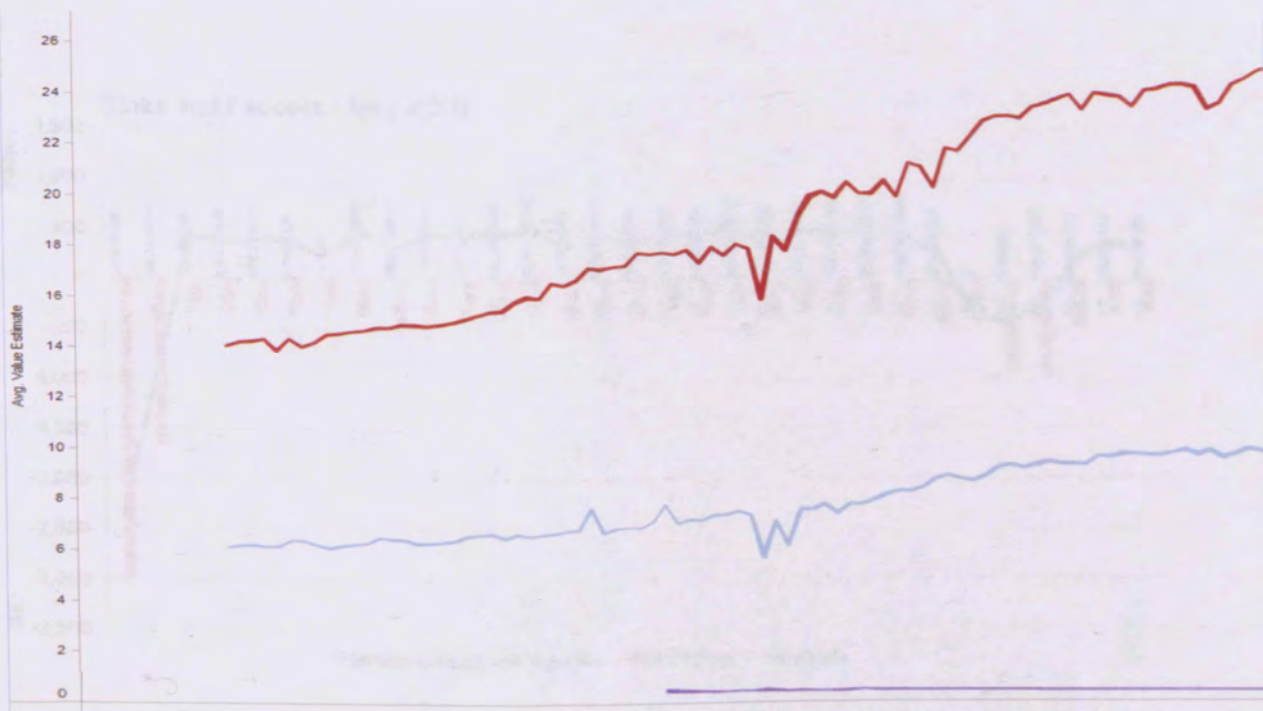
Figure 2



The Daily mineral price index for EVE, showing the game's response to various events in terms of inflation.

A graph depicting the estimates of the relative price of three popular EVE items: Carbide (in red), Bill's hat (in blue) and refined metal (in green). The graph shows the price index for these items from November 2011 to 1<sup>st</sup> June 2012.

Figure 3

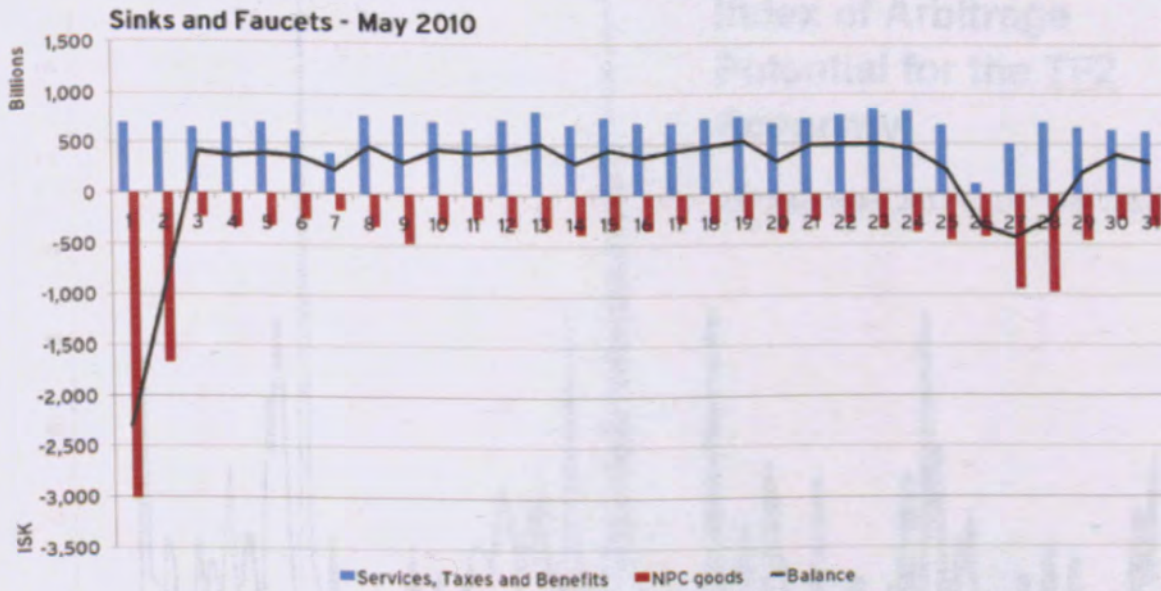


"A graph depicting our estimates of the (relative) price of three popular TF2 items: earbuds (in red), Bill's hat (in blue) and refined metal (in purple). [Note that this diagram pertains to the period between November 2011 and 1<sup>st</sup> June 2012.]"<sup>84</sup>

<sup>84</sup> <http://blogs.valvesoftware.com/economics/arbitrage-and-equilibrium-in-the-team-fortress-2-economy/#more-128>



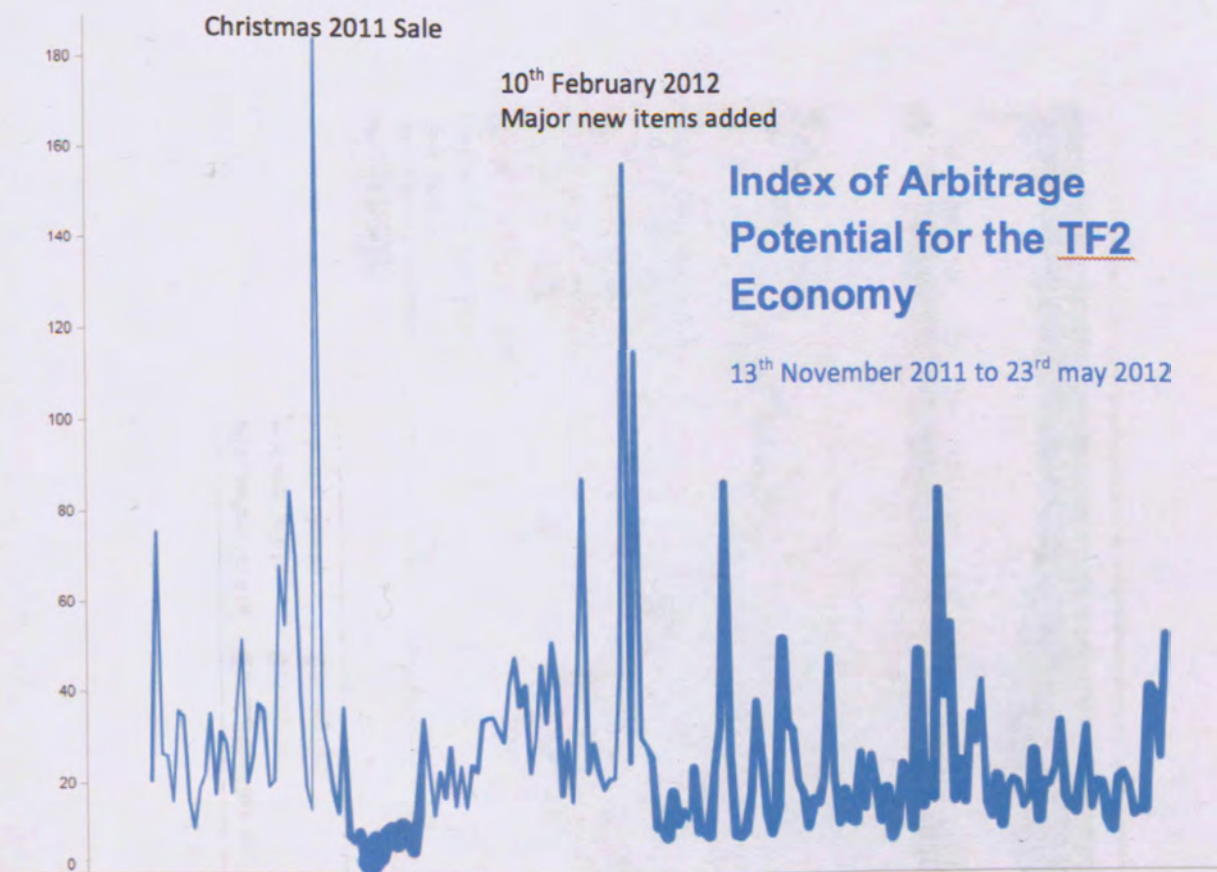
Figure 4



The balance of the money sinks and faucets in EVE Online. Note that the balance is usually positive, meaning that more currency enters than leaves.

Figure 5

Figure 5



"The peaks represent moments when there was a great deal of room for arbitrage (i.e. for buying low and selling high), while the line's thickness reflects the volume of actual trades. It is no great surprise that these peaks coincided with major new releases and sales (e.g. the Christmas sale) that the community required some time to price properly."<sup>85</sup>

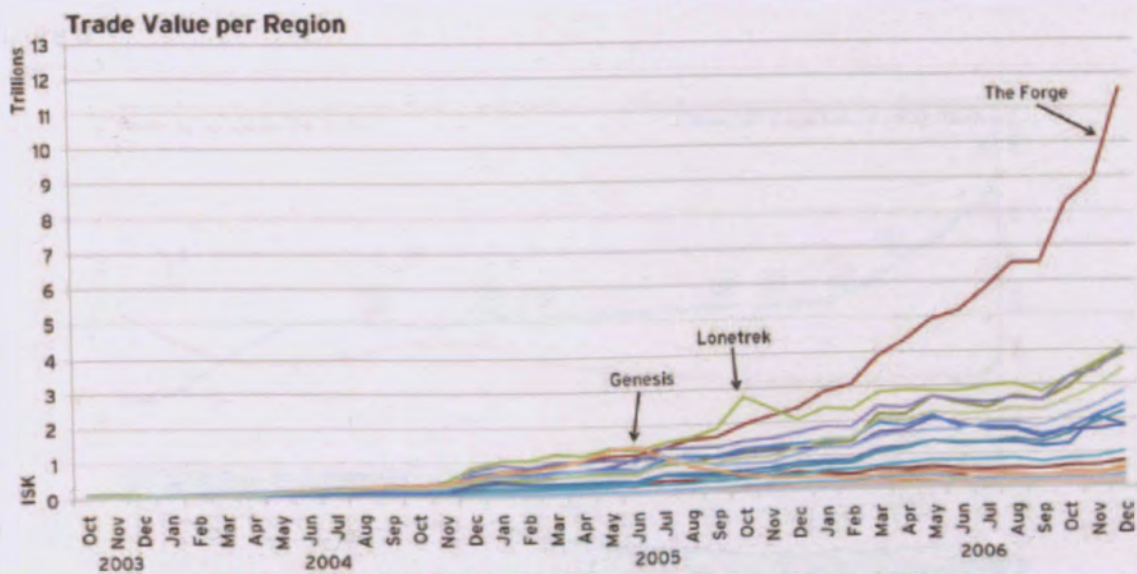
Figure 6

<sup>85</sup> <http://blogs.valvesoftware.com/economics/arbitrage-and-equilibrium-in-the-team-fortress-2-economy/#more-128>





Figure 7



**Figure 16:** The graph shows The Forge taking off in 2005 and leaving the other regions far behind. The spike in Lonetrek trade in October 2005 was caused by extreme trading in NPC trade goods, primarily Protein Delicacies. Presumably, players found some lucrative loopholes in the NPC trading system.

This figure shows the different value in trade in each region in EVE. Over time, the population of the game increased, which was one factor in changing the volume and value of trade.



Figure 8



These figures show the value of earbuds (bottom graph), and keys (top) in terms of other items. Metal's value relative to keys has gone down over time, whereas earbuds have gone up in terms of their value over time.